



**US Army Corps
of Engineers**
Construction Engineering
Research Laboratories

**USACERL Technical Report-95/40
September 1995**

The Standard Data Exchange Format for Critical Path Method Scheduling

by E. William East

The U.S. Army Corps of Engineers faces a dilemma in seeking to automate construction project scheduling with Critical Path Method (CPM) software systems, because each vendor uses its own proprietary data format. To purchase and learn each system used by various contractors would be prohibitively expensive and time consuming. Yet specifying a system leaves the Corps open to charges of giving unfair advantage to contractors using that particular system. Requiring contractors to provide hardware, software, and training for any CPM scheduling system differing from the one specified by the Corps can keep a contractor from being able to submit a competitive bid on a smaller project.

To solve this dilemma, the U.S. Army Construction Engineering Research Laboratories (USACERL) has developed a standard data format that provides a common ground between proprietary systems: the Standard Data Exchange Format (SDEF). This report chronicles the development of this format, and a draft of its specifications is included in Appendix A. Additionally, this report evaluates how well commercially available systems from the following vendors conform to the SDEF: AlderGraf Systems, Inc.; Welcom Software Technology Corporation (Open Plan); Pinnell-Busch, Inc. (PMS-80); Advanced Project Approach, Inc. (PPMS 30,000 Version 4.02); and Primavera Systems, Inc.

19960130 012

INFO QUALITY ENHANCED 1

The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products. The findings of this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

DESTROY THIS REPORT WHEN IT IS NO LONGER NEEDED

DO NOT RETURN IT TO THE ORIGINATOR

USER EVALUATION OF REPORT

REFERENCE: USACERL Technical Report 95/40, *The Standard Data Exchange Format for Critical Path Method Scheduling*

Please take a few minutes to answer the questions below, tear out this sheet, and return it to USACERL. As user of this report, your customer comments will provide USACERL with information essential for improving future reports.

1. Does this report satisfy a need? (Comment on purpose, related project, or other area of interest for which report will be used.)

2. How, specifically, is the report being used? (Information source, design data or procedure, management procedure, source of ideas, etc.)

3. Has the information in this report led to any quantitative savings as far as manhours/contract dollars saved, operating costs avoided, efficiencies achieved, etc.? If so, please elaborate.

4. What is your evaluation of this report in the following areas?

a. Presentation: _____

b. Completeness: _____

c. Easy to Understand: _____

d. Easy to Implement: _____

e. Adequate Reference Material: _____

f. Relates to Area of Interest: _____

g. Did the report meet your expectations? _____

h. Does the report raise unanswered questions? _____

i. General Comments. (Indicate what you think should be changed to make this report and future reports of this type more responsive to your needs, more usable, improve readability, etc.)

5. If you would like to be contacted by the personnel who prepared this report to raise specific questions or discuss the topic, please fill in the following information.

Name: _____

Telephone Number: _____

Organization Address: _____

6. Please mail the completed form to:

Department of the Army
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES
ATTN: CECER-TR-I
P.O. Box 9005
Champaign, IL 61826-9005

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave Blank)

2. REPORT DATE

September 1995

3. REPORT TYPE AND DATES COVERED

Final

4. TITLE AND SUBTITLE

The Standard Data Exchange Format for Critical Path Method Scheduling

5. FUNDING NUMBERS

MIPR
E8595Z017

6. AUTHOR(S)

E. William East

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

U.S. Army Construction Engineering Research Laboratories (USACERL)
P.O. Box 9005
Champaign, IL 61826-9005

8. PERFORMING ORGANIZATION
REPORT NUMBER

TR 95/40

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Headquarters, U.S. Army Corps of Engineers (HQUSACE)
ATTN: CEMP-CE
20 Massachusetts Ave., NW.
Washington, DC 20314-1000

10. SPONSORING / MONITORING
AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

Copies are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

12a. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

The U.S. Army Corps of Engineers faces a dilemma in seeking to automate construction project scheduling with Critical Path Method (CPM) software systems, because each vendor uses its own proprietary data format. To purchase and learn each system used by various contractors would be expensive and time consuming. Yet specifying a system leaves the Corps open to charges of giving unfair advantage to contractors using that particular system. Requiring contractors to provide hardware, software, and training for any CPM scheduling system differing from the one specified by the Corps can keep a contractor from being able to submit a competitive bid on a smaller project.

The U.S. Army Construction Engineering Research Laboratories (USACERL) has been working on a solution: establishing a standard data format that provides a common ground between proprietary systems. This report chronicles the development of this format, named the Standard Data Exchange Format (SDEF). Appendix A to this report is a draft of the SDEF specifications.

Additionally, this report evaluates how well the following commercially available systems conform to the SDEF: AlderGraf (AlderGraf Systems, Inc.); OpenPlan (Welcom Software Technology Corporation); PMS-80 (Pinnell-Busch, Inc.); PPMS 30,000 Version 4.02 (Advanced Project Approach, Inc.), and Primavera (Primavera Systems, Inc.).

14. SUBJECT TERMS

construction contracts
construction scheduling
Standard Data Exchange Format (SDEF)

15. NUMBER OF PAGES
122

16. PRICE CODE

17. SECURITY CLASSIFICATION
OF REPORT

Unclassified

18. SECURITY CLASSIFICATION
OF THIS PAGE

Unclassified

19. SECURITY CLASSIFICATION
OF ABSTRACT

Unclassified

20. LIMITATION OF
ABSTRACT

SAR

Foreword

This study was conducted for Headquarters, U.S. Army Corps of Engineers (HQUSACE) under Military Interdepartmental Purchase Request E8595Z017; Work Unit QI5, "Standard Data Exchange Format Test." The technical monitors were Robert Chesi, CEMP-CE and Stan Green, CEMP-CE.

The work was performed by the Engineering Processes Division (PL-E) of the Planning and Management Laboratory (PL), U.S. Army Construction Engineering Research Laboratories (USACERL). The USACERL principal investigator was E. William East. Michael P. Case is Acting Chief, CECER-PL-E, L. Michael Golish is Acting Operations Chief, CECER-PL, and David M. Joncich is Chief, CECER-PL. The USACERL technical editor was Audrey J. Fisher, Technical Resources.

COL James T. Scott is Commander and Acting Director, and Dr. Michael J. O'Connor is Technical Director of USACERL.

Contents

SF 298	1
Foreword	2
List of Tables	5
1 Introduction	9
Background	9
Objectives	10
Approach	10
Scope	10
Mode of Technology Transfer	11
2 History of the SDEF Development	12
Proprietary Specifications Spark Bid Protests	12
Format Workshop - September 1988	13
Format and Testing and Results - Summer 1989	14
Format Specification - March 1990	16
Creating the SDEF	17
Software Testing—July 1994	18
Software Testing—January 1995	18
3 Recommended Vendors	24
4 Conclusions and Recommendations	25
References	26
Appendix A: Draft SDEF Specification	27
Appendix B: July 1994 Test Personnel	42
Appendix C: July 1994 Questionnaire	44
Appendix D: AlderGraf, Version 5.2	47
Appendix E: Open Plan, Version 5.1	61
Appendix F: PMS-80, Version 6.40	75

Appendix G: PPMS-30,000, Version 4.02 89

Appendix H: Primavera, Version 5.1 (DOS) 103

Distribution

List of Tables

Tables

1	Recommended SDEF vendors	24
D1	AlderGraf Volume Record data format	48
D2	AlderGraf Project Record data	49
D3	AlderGraf Calendar Record data format	50
D4	AlderGraf Holiday Record data format	51
D5	AlderGraf Activity Record data format	52
D6	AlderGraf Precedence Record data format	54
D7	AlderGraf Unit Cost Record data format	55
D8	AlderGraf Progress Record data format	56
D9	AlderGraf Project End Record data format	59
E1	Open Plan Volume Record data format	62
E2	Open Plan Project Record data format	63
E3	Open Plan Calendar Record data format	65
E4	Open Plan Holiday Record data	66
E5	Open Plan Activity Record data format	67
E6	Open Plan Precedence Record data format	69
E7	Open Plan Unit Cost Record data	70
E8	Open Plan Progress Record data format	71

E9	Open Plan Project End Record data format	73
E10	Open Plan test project activity list	74
F1	PMS-80 Volume Record data format	76
F2	PMS-80 Project Record data format	77
F3	PMS-80 Calendar Record data format	79
F4	PMS-80 Holiday Record data format	80
F5	PMS-80 Activity Record data format	81
F6	PMS-80 Precedence Record data format	83
F7	PMS-80 Unit Cost Record data format	84
F8	PMS-80 Progress Record data format	85
F9	PMS-80 Project End Record data format	87
F10	PMS-80 test project data	88
G1	PPMS Volume Record data format	90
G2	PPMS Project Record data format	91
G3	PPMS Calendar Record data format	93
G4	PPMS Holiday Record data format	94
G5	PPMS Activity Record data format	95
G6	PPMS Precedence Record data format	97
G7	PPMS Unit Cost Record data format	97
G8	PPMS Progress Record data format	98
G9	PPMS Project End Record data format	100
H1	Primavera Volume Record data format	104

H2	Primavera Progress Record data format	105
H3	Primavera Calendar Record data format	107
H4	Primavera Holiday Record data format	108
H5	Primavera Activity Record data format	109
H6	Primavera Precedence Record data format	111
H7	Primavera Unit Cost Record data format	112
H8	Primavera Progress Record data format	113
H9	Primavera Project End Record data format	116
H10	Primavera test project	118

1 Introduction

Background

Since personal computers came into widespread use, vendors of construction scheduling software have tried to make getting data into a critical path method (CPM) system as easy as possible through sophisticated types of data entry, including table editors, customizable data entry screens, and Graphical User Interfaces (GUI). CPM features such as resource analysis, progress and cost features, and default activity progress data reduce manual data input and analysis. Output to laser printers and plotters is easy to produce, attractive, and of very high quality (East 1988).

1990

With all of this automation power available, why then has such software not reduced the need for a full-time human scheduler for construction projects? One reason is that project participants have difficulty receiving scheduling data in a useful form. Often, project data is transferred between project participants on paper. This format requires each office to retype the schedule into the local scheduling software and then check for errors. Retyping and checking schedule data could easily take several days for a small project, and up to a week for large projects. Data might also need to be retyped and checked every time a schedule is updated or changed.

Transferring project data electronically rather than manually would significantly reduce both transfer time and labor costs. Today there are several ways to support electronic file transfer. The most common mechanisms are supported by individual scheduling software vendors; however, each vendor uses their own proprietary system to handle and translate the data. Many vendors have implemented direct data transfers among the different proprietary systems, but the data transfer mechanisms must be constantly updated as each software system is updated.

One government agency, the Veteran's Administration (VA), has an electronic file format that may be used to transfer data tapes between the contractor and VA offices. However, the VA format requires the use of centralized, mainframe-based scheduling that is impractical for most organizations. In addition, the VA format does not support new scheduling capabilities now commonly used, such as precedence diagramming techniques.

Objectives

The objective of this SDEF project is to develop and implement a standard data format and planning protocols across the entire construction industry. This will reduce the cost of construction projects through increased efficiency and effectiveness of project control techniques.

Approach

Constant support over a period of six years from the Construction Division and Construction Evaluation Branch of the Military Programs Directorate of the U.S. Army Corps of Engineers allowed the U.S. Army Construction Engineering Research Laboratories (USACERL) to facilitate the development of an industry standard for the exchange of project planning and control information.

A preliminary standard format was created, and specifications were developed by combining the best parts from Corps of Engineers and private industry specifications. At the same time, it was agreed that the standard should apply to as many scheduling systems as possible with as little computer programming effort as possible, and that the standard should be flexible enough to be used on a wide range of construction projects.

Testing of the preliminary format at the Omaha and Alaska Districts led to revisions. The revised format is the Standard Data Exchange Format (SDEF). Vendors' products were tested against the SDEF's requirements in July 1994 and January 1995, to see if they were SDEF compatible.

Finally, a validation program was written to allow Construction Field Office personnel to determine if a Contractor's data disk meets the format. This program is named the SDEF Checker.

Scope

The SDEF is required for all contractors working on Corps of Engineers Projects where the Corps of Engineers Construction Office will be evaluating contractors' construction schedules using inhouse software; these contractors must exchange scheduling and progress data using the SDEF.

This report describes the development of the SDEF and software testing conducted in July 1994 and in January 1995. Appendices describe the SDEF and compare five vendors' products against its requirements.

Mode of Technology Transfer

This project began through the collaboration of over 20 commercial software vendors. These vendors have incorporated the SDEF into their systems and will provide users of their systems with documentation. Ultimately, five vendors included the format developed directly into their commercial software products.

Guide Specification 01310 (December 1994), "Project Schedule," requires the use of the SDEF. The Appendix to the U.S. Army, Corps of Engineers Engineering Regulation ER 1-1-11 contains the SDEF Technical Specifications. The SDEF Checker program, which checks whether a contractor's data disk meets the SDEF, is available on the Internet and the CivilNet (for location information, contact U.S. Army Corps of Engineers, ATTN: Bill East [CECER-FFA], P.O. Box 9005, Champaign, IL 61826-90005).

Coordination with other Federal agencies is being accomplished through the Federal Facility Council to promote the format across all Federal agencies in charge of construction.

2 History of the SDEF Development

Proprietary Specifications Spark Bid Protests

In 1986, USACERL was contacted to assist the U.S. Army Corps of Engineers, Seattle District with a problem concerning their scheduling specifications. The Seattle District was being confronted with a wide range of CPM software used by Corps contractors. At the time, the District had only two options: either to specify a single scheduling system, or to purchase and learn each contractor's scheduling system. Daunted by the prospect of reviewing contractor schedules produced by a potentially unlimited number of different software packages, Seattle District chose to specify a single software system. This created a new problem: a software vendor submitted a bid protest, citing the proprietary nature of the specification.

Prompted by the bid protest, specifications from other districts were reviewed. In addition to requirements for specific software, other, more subtle types of proprietary specifications were found. One of the most frequent was that contractors would be required to provide hardware, software, and training for any scheduling software they wished to use that was not the same as the Corps'. On smaller projects, this essentially required contractors to either revise their own internal business practices or not submit a competitive bid. Another type of specification encountered required the contractor to submit a data disk containing the scheduling information in the proprietary format of the vendor used by the Construction Office.

After consultation with various software vendors and Corps personnel, a new option emerged. This option would allow contractors to use whatever software they wanted to, then Corps personnel would be able to import the contractor's schedule into the Corps system. This new option would eventually become the Standard Data Exchange Format (SDEF).

The idea was that if a common denominator could be found between all the commercial software vendors, then a standard data format could be specified that would provide advantage to no individual vendor. A draft format was circulated to the manufacturers of PMS-80, Open Plan, Primavera, PROMIS, PMSII, PPMS30,000, and ViewPoint, and provided to the Seattle District on 14 January 1987.

Format Workshop - September 1988

In the summer of 1988, the Corps of Engineers National Quality Assurance Team met and determined the need to develop a generic format for data exchange between project management scheduling programs. As a result, the "Project Management System Data Exchange Format" project was initiated, and a workshop was held in September 1988 to review a draft format. Workshop participants included software vendors, representatives of construction industry associations, construction management firms, and Corps of Engineers personnel. The goal of the workshop was to "allow project management systems to easily share information with other programs. The focus of the data exchange standard will be transferring scheduling data between project management systems." (Conference notes, 1988)

The participating software vendors were: Advanced Project Approach, Inc. (PPMS-30,000), AlderGraf Systems, Inc. (AlderGraf Scheduling System), Computerline (Plantrac), North American Mica, Inc. (PMS-II), Pinnell Engineering, Inc. (PMS-80), Primavera (Primavera Project Planner), Strategic Software Planning Corp. (PROMIS), and Welcom Software Technology (Open Plan). Representatives from the National Construction Software Association (NCSA) and the Construction Management Association of America (CMAA) attended the conference. One construction management firm, Brownell, Bitner, and Associates was represented, and several attendees performed scheduling and claims consulting in conjunction with software development. Finally, there were representatives from several different parts of the Corps of Engineers, from the Chief of Engineers Office to construction field offices.

To guide the development of the format, the following assumptions were agreed upon: First, that the standard should apply to as many scheduling systems as possible with as little computer programming effort as possible. Second, that a complete set of project data would be provided with every schedule update. Third, that the standard should be flexible enough to be used on a wide range of construction projects.

It was also agreed that to support a wide range of projects, the potential format would need to include two different types of data fields. Required data fields in the standard represent minimum data, and provide an adequate level of schedule control for most smaller projects. Optional fields support larger project scheduling requirements. Specific guidelines were to be developed regarding when specification writers should include the optional fields.

Following the September 1988 workshop, a proposed data exchange format and specifications governing its use were developed. The specifications were developed by combining the best parts from a large number of Corps of Engineers and private

industry specifications. Additional sections were written to give contractors precise information about how to use the schedule. Certain sections of the specification also described the ownership of float, the contents of progress update meetings, time management techniques, requirements for schedule updates to justify time extensions, and who would be responsible to pay for schedule changes. The purpose of these sections was to clarify the use of scheduling to contractors. The opening section of the specification, shown below, describes how and why the schedule will be used on the project.

The [CPM network] is required to assure adequate planning and coordination of the contract work with the work of others; for providing a means of measuring the execution of the work; to assist the Contracting Officer in appraising the reasonableness of the proposed schedule, in appraising future funding requirements, to aid in evaluating the progress of work, and assist in the evaluation of time extensions (ER 1-1-11, Appendix B, 15 March 1990, p 3, item 8).

Format and Testing and Results - Summer 1989

Two Districts, Alaska and Omaha, were selected to become test sites for the format developed in September 1988. The results from these Districts were discussed at a second workshop held in June 1989. According to the Omaha District test report, the exchange of the data "went very well with no significant problems." The conclusion of the Omaha District test was:

The Omaha District feels this data exchange format will greatly benefit our construction management efforts by enabling and promoting the use of computers in schedule analysis. The benefit will be most tangible in the purchase of and training on one brand of software rather than unique software for each project. The time spent learning and becoming proficient on one brand of software will be greatly reduced.

The Omaha District feels that this standard format for scheduling data exchange should be put into use by as many software vendors as possible, and as soon as possible. (East et al. 1989, p 45)

While the Alaska District test report supported the idea of the data exchange format, the author of the test report was not quite as positive about the role of the software vendors, who apparently failed to update their software correctly:

This test was unable to fully evaluate the two proprietary programs, it was discovered our Resident Office had the incorrect version of [system name] and the

software did not function as expected. Time and budget constraints would not permit the procurement of the proper version in time. This was a problem not foreseen at the onset and Omaha test site did accomplish the data transfer with the correct software. The data exchange format received in the test was manually checked and would have successfully loaded. The alternate [system name] program produced the proper output report, but would not transfer back due to incorrect software versions. Both of the programs tested could have functioned if all software needed for the test had been provided by the vendors. More testing is needed to solve inherent compatibility problems. Test was successful enough for use on another project. (East et al. 1989, p 71)

In addition to the tests at Omaha and Alaska Districts, the format was distributed to all Divisions and Districts in May 1989 for comment. While Districts who had existing specifications for particular software systems were unclear as to the intent of the specifications, several Districts responded very positively to the idea of a standard data exchange format. Several representative samples of the results are provided below.

The format is past due. Your projected benefits/savings from implementation of the standard appear to be conservative. Also, maybe scheduling will finally become "standard." If this occurs, benefits in efficiency and costs savings could be enormous.

--Chief, Construction Division,
Nashville District (Hall, 1989)

The development of a data exchange standard is essential if we are to fully benefit from the power of modern scheduling systems.

--Acting Chief, Construction-Operations,
North Pacific Division (Schmidt, 1989)

Standardization of scheduling data exchange format will allow the Corps and construction contractors to use a program best suited to their needs and eliminate the necessity in learning new software. We support this standard.

--Chief, Construction-Operations Division,
Ohio River Division (Kiper, 1989)

Most of these Districts thought that the idea of data exchange was good but that the draft specifications that accompanied the format should be revised. One respondent correctly indicated that any change to guide specifications should be initiated by HQUSACE, not USACERL, but concluded that:

Notwithstanding the above criticism, the draft specifications are good, and greatly needed. The approach to data exchange is excellent, and will assure compatibility without limiting competition.

--Acting Chief, Construction Division,
Kansas City District (Gillian, 1989)

While initial results appeared positive, the tests at Omaha and Alaska hit snags due to problems with incompatible scheduling software, the lack of resources required to determine if data submitted were in the correct format, and the short duration of the test.

The results of the format test, as reported in August 1989, were not as positive as they had initially seemed. An examination of the details of the Omaha District's report uncovered that some data items had not been provided by the scheduling system used by Omaha District. This additional data needed to be entered manually into the file for the data exchange to occur. Also, Omaha District did not use many of the optional items included in the data exchange format. The Alaska District also had difficulties with the use of the format, due to unresponsive vendor participation.

Format Specification - March 1990

Based on the optimistic interpretation of test results and because of potential benefit to the construction field offices, a final draft of the format was developed and included in Corps of Engineers regulation ER 1-1-11 in March 1990 as Appendix B. There was no testing program to ensure that vendors fully complied with the format, with the result that the import and export routines of various systems differed.

To make files work, users would first have to perform detailed testing to determine how to obtain the correct data in the correct place within the data exchange format, because the vendors' system documentation did not provide sufficient information. While some of the requirements were quite simple (for example, using only the first 30 characters of an activity description so that activity names would not be truncated), other system's requirements forced users to set up a complicated set of dictionaries for activity codes. Some systems required that the user create new screen forms to customize the existing user interface.

Many systems also had features that were beyond the capabilities of the SDEF to represent. The use of multiple resources and different types of milestones are two

examples. Vendors did not adequately warn users against using such specialized features during the creation of data exchange projects.

Once a file was created, changes might still be needed to allow it to be exported. For example, some systems produced files that began with a blank line. This blank line would have to be deleted. Even if the entire file was correct, a simple additional line at the beginning of a file caused most import routines to fail. Other systems required that the identification for the first data disk be provided in the file as disk "01". In this case, the preceding zero had to be added before importing any files.

Although CPM is commonly used to model contraction, there are significant differences between various software vendors' implementation of CPM. Many systems allow the use of default calculation methods, such as not requiring Actual Start and Actual Finish dates on activities that have been fiscally completed. In addition, time-based percent completes are often used to drive the earned value of an activity. In the area of cost- and time-based completion, vendors provided insufficient documentation about the correct combination of software features needed to produce the data disk.

The March 1990 format included required and optional data items. Many of the optional data items could be user-defined. It was hoped that these user-defined items would be useful for larger projects. Unfortunately, user-defined items were also a point of confusion.

In addition to the problems of needing to reverse-engineer the computer software, tinker with the results of the output, and determine the meaning of optional items, vendors' own sales representatives hindered application of the format. Several construction field offices representatives reported to the author that vendor salespeople were actively recommending against the use of the format in lieu of purchasing their proprietary systems. Although the national offices of many vendors were fully aware of the March 1990 format, reports of sales representatives indicated that they were generally not aware that there was a generic format for the exchange of project planning data.

Creating the SDEF

As a result of the difficulties with the March 1990 format, a new format was prepared. This format revised three areas of the March 1990 format. First, optional and user-defined codes were replaced with a specific set of activity codes. Second, new information related to the scheduled dates for activities and their total float was included in the format. Finally, some changes were made to activity costs. These

changes were made to give more specific direction to previously confusing data, and to allow the data in the format to be used by other construction management information systems. The draft of this revised format that will be published in a revision of ER 1-1-11 is contained in Appendix A.

A new, official name was selected for the revised format: the Standard Data Exchange Format (SDEF). The new name and the format were announced by the Chief of Engineers to software vendors in August 1993. Over 200 vendors were initially contacted. Thirty of these vendors requested information on the format. Six vendors, covering approximately 95 percent of Corps of Engineers offices, submitted software for testing. These vendors (with their products listed in parentheses) were: Advanced Project Approach, Inc. (PPMS 30,000), AlderGraf Systems, Inc. (AlderGraf), Integrated Software Systems (Time Machine), Pinnell-Busch, Inc. (PMS-80), Primavera Systems, Inc. (P3 for DOS) and Welcom Technologies Corporation (Open Plan).

Software Testing—July 1994

A session to test software against the SDEF, conducted by Corps of Engineers District and Construction Office representatives, was held on the campus of the University of Illinois in July 1994. Appendix B lists the names, addresses, and telephone numbers of the testing personnel.

The testers reviewed the submitted software using the test questionnaire shown in Appendix C. Sample projects were created to test import and export routines. The result of the evaluation was that vendors did not fully meet the format's requirements. In addition to not correctly producing SDEF files, many software systems did not provide sufficient documentation. Tinkering with the resulting data exchange file was also necessary for some systems.

The July 1994 testers concluded that none of the vendors who submitted software performed adequate quality control testing to ensure that their software fully met the SDEF format. Vendors were given a list of specific items to correct and were asked to resubmit software for a final confirmation test in January 1995.

Software Testing—January 1995

Five of the six vendors who submitted their products for the July 1994 test resubmitted them for January 1995. Only Integrated Software Systems (Time

Machine) did not implement the noted changes. USACERL conducted tests on the remaining five vendors' systems.

The January 1995 testing consisted of a detailed review of each software system to determine the exact correspondence between the SDEF data fields and the fields in that scheduling software system. Several simple projects were developed or modified from existing examples to provide a set of test cases. These test projects were manually entered into the software systems, and the SDEF export file was run through the SDEF Checker program. While creating the test projects, testers tried out the various permutations of values available at each significant data field and evaluated the impact on the resulting SDEF file or imported data.

Each system tested was installed according to the user's manual and supplemental instructions on the test platform described below. The testing resulted in incremental refinement of vendors' SDEF import/export routines into February 1995. Many vendors submitted four or five additional program updates to USACERL to fix some aspect of their SDEF routines. By mid-February of 1995, vendors' SDEF import/export routines had stabilized enough to announce the list of vendors recommended for use with the SDEF specification. The detailed evaluation of each system is provided in Appendix D through Appendix H.

Test Platform

The test platform was an IBM-compatible personal computer with the following configuration:

Processor:	Intel 80486/66 Mhz
Operating System:	MS-DOS version 6.20
Largest Executable Program Size:	610 KB
Free Extended Memory Free:	31,680 KB
Memory Driver:	MS-DOS himem.sys
Network:	not installed (to maximize available memory)
Windows:	not installed (to maximize available memory)
Mouse Driver:	C:\WINDOWS\MOUSE.SYS /Y

The contents of the AUTOEXEC.BAT file are shown below. (PATH and SET command lines for each system were customized as required by that software system.)

```
PROMPT $p$g  
PATH=C:\DOS;C:\BIN
```

The contents of the CONFIG.SYS file are shown below.

```
DEVICE=C:\DOS\HIMEM.SYS  
DEVICE=C:\DOS\ANSI.SYS  
DEVICE=C:\WINDOWS\MOUSE.SYS /Y  
BUFFERS=16  
FILES=128  
DOS=HIGH,UMB  
LASTDRIVE=E  
FCBS=16,0  
STACKS=9,256
```

Issues Raised

During the testing, several important issues were raised regarding requirements of the SDEF files. These issues are described below and may in the future help further clarify SDEF requirements.

Volume Record Clarification. The first line of an SDEF-compatible file must contain the VOLM record. Systems must make sure that the export routines do not place a blank line as the first line in the SDEF file. If the VOLM record is not the first line of the file, the file will be rejected by other systems as non-SDEF compatible.

Project Record Clarification. The second record in an SDEF file, PROJ, contains global information about a project. This global information, while useful, may also impact schedule calculations in ways that are inconsistent between scheduling software. Vendors have been asked to include a discussion of the following paragraph in revised SDEF documentation:

The use of "project start" and "project end" dates differs between systems. Because these dates may result in different schedule calculations when used in various software systems, it is recommended that users do *not* provide information on global project start and end dates. A project start date, for example, may require that the first activity in the schedule occur on a specific date or only after a certain date. The recommended way to ensure that projects start at the same time regardless of the scheduling system used is by placing a early start constraint on the first activity in the schedule. Similarly, rather than using a global project end date, using a finish no later than constraint on the last activity of the schedule will

produce a project plan that can be scheduled consistently between various software systems.

Calendar Record Clarification. The Calendar Record and ACTV record allow calendar designations to be alphanumeric. This feature is not supported by several vendors who require numbers for calendar codes. Vendors have been notified, and agreed, that calendar codes may only take values from 1 to 9.

Activity Identifier Clarification. The SDEF requires that the activity identification in the ACTIVITY ID field be an integer. Because many users and systems allow letters and numbers in the ACTIVITY ID field, users may want to determine the requirements of the systems being used by every other project team member. If the project team's systems all support alphanumeric activity identifications, then alphanumeric activity identification should be allowed. If, however, not all systems support the alphanumeric activity identification, then only integers should be allowed.

Activity Code Clarification. When the SDEF Checker program reviewed the ACTIVITY RECORD in the test projects, many activity codes were found to be blank. The SDEF requires that activity codes be present for all activities; however, there are many situations where project planners may not include activity codes. Because activity codes provide the basis for analyzing project plans, and are essential for progress reporting, the following alternatives are suggested for these situations, to ensure that all activities have a complete complement of codes.

The first case of activities that may not have codes are non-work activities. Non-work activities frequently do have a complete set of activity codes because these codes may not appear to be appropriate for the non-work activity. For example, an activity "Notice to Proceed" does not immediately appear to have a "responsibility" or trade associated with it. The activity does, however, have a responsible party, namely the owner who issues the order to start the project. To code such an activity, a code value should be created for each member of the construction team. Another example of a non-work activity that might be without a code is that of "phase of work" for an activity called "Deliver Steel." In this case it is recommended that a phase of work coded as "P" for procurement or "DE" for delivery be developed. In each case of non-work activities, meaningful activity codes may be created by taking a global project view.

Another approach to the missing activity codes is to run the SDEF Checker program to identify activities without codes. After providing activity codes where appropriate, using the strategies described above, rerun the SDEF Checker and turn off checks for the remaining activity codes that are missing. Note that while turning off checks

allows schedules to be approved without a full complement of codes, it may not allow project managers to fully evaluate the schedule.

The other case of missing activity codes occurs with dummy activities in arrow diagrams. Dummy activities will produce SDEF Checker activity code errors just like any other activity if the activity codes are missing. It is recommended that users run the SDEF Checker once with all activity code options turned on, and then make sure that only dummy activities are missing activity codes. Once satisfied that only dummy activities are missing activity codes, the option to check the activity codes may be turned off. Rechecking the file will then ignore the missing codes on dummy activities.

Unit Cost Clarification. For systems that support unit costs, the Unit Cost Record caused the most problems in conforming to recommended SDEF usage. The difficulty results from the differences between systems when it comes to the area of resources. Those interested in unit costs should be aware that the systems require (1) manual calculation of ACTIVITY COST and COST TO DATE in the Progress Record and (2) detailed understanding of the resource systems for the software importing and exporting the unit cost data.

As noted in the SDEF, only one unit cost item may be associated with a single activity. If there are several activities that have the same type of unit cost item, then these will be identified as activities that have the same pair of "cost per unit" and "unit of measure" fields.

Activity Costs Clarification. Three cost items in the Progress Record caused some confusion. As happens with most nomenclature for costs, different people have different definitions for the same items. Vendors implementing the SDEF in the future should review the definitions of the data items to ensure that the most appropriate software field is mapped to the SDEF data field. For example the COST TO DATE field description corresponds to the earned value for the tasks. For those systems that have implemented the Cost/Schedule Control System (C/SCS) control process, the SDEF costs are the budgeted and actual earned value., and the STORED MATERIAL cost should be included in the COST TO DATE field.

If there is a unit cost record associated with the activity, then the values for the ACTIVITY COST and COST TO DATE should be generated by the Unit Costs Record. Manual calculation is frequently required to ensure that costs fields for UNIT COST or for STORED MATERIAL are correctly reflected in the Progress Record.

Activity Actual Date Clarification. CPM scheduling requires that activities that have started have an actual start date and that completed activities have an actual finish date. Software systems have frequently allowed users to deviate from this requirement by providing default values for start and finish dates if dates have not been provided. The SDEF requires an ACTUAL START DATE if either the REMAINING DURATION is less than the ORIGINAL DURATION, or if the ACTUAL COST costs or STORED MATERIAL costs are greater than zero. An ACTUAL FINISH DATE is required when the REMAINING DURATION is equal to zero. The ACTUAL COST field need not be equal to the budgeted cost for activities identified as completed, because there may be punch-list or other uncompleted items for which funds are being withheld.

While testing has identified some situations where the use of default dates has resulted in creation of incorrect SDEF files, not all features of every system have been tested to 100 percent confidence. Vendors have been asked to include in their documentation a suggestion that users do not utilize these default dates unless the results have been fully investigated.

3 Recommended Vendors

All of the five scheduling systems resubmitted to USACERL for testing in January 1995 were able to export and import files that complied with the SDEF format. Table 1 lists the vendor and point of contact for each of these systems, and Appendices D through H describe their SDEF capabilities. Users of these systems who wish to use the SDEF routines should review the appropriate Appendix, and should contact the vendor for supplemental vendor documentation to ensure that the version of the software currently in circulation contains the most recent SDEF routines.

Recommendations for changes to these products for enhanced compatibility with the SDEF are presented in each product's respective Appendix.

Table 1. Recommended SDEF vendors.

Product	Company	Point of Contact	Telephone Number
AlderGraf v. 5.2	AlderGraf Systems, Inc.	Leon Alderfer	(713) 467-8500
Open Plan v. 5.1	Welcom Software Technology (WST Corporation)	Chris Jenson Randy Armstrong	(713) 558-0514
PMS-80 v. 6.40	Pinnell-Busch Engineers, Inc.	Perry Smith	(503) 293-6280
PPMS 30,000 v. 4.02	Advanced Project Approach, Inc.	Justin Smith	(214) 929-1877
Primavera v. 5.0	Primavera Systems, Inc.	Hank Norris Marko Vranich	(215) 667-8600

4 Conclusions and Recommendations

To provide compatibility between differing proprietary construction scheduling systems, USACERL has developed a standardized format, the SDEF, to provide a common denominator for data exchange between systems. This format has been appended to ER 1-1-11 and is required of all contractors for Corps of Engineers projects requiring electronic schedule information. (An earlier format appears as Appendix B in ER 1-1-11, but this is not the SDEF.) The Corps of Engineers Guide Specification (CEGS) governing project scheduling, CEGS-01310 (December 1994), contains the necessary contract language to effectively use the SDEF. Appendix A shows a draft of the SDEF specification.

Five vendors have demonstrated compatibility with the SDEF. Appendices D through H guide users of these vendors' products in creating, importing, and exporting projects in the SDEF. Recommendations for changes to these products for enhanced compatibility with the SDEF are presented in each product's respective Appendix. Vendors will be making, or already have made, many of these recommended changes.

References

Associated General Contractors of America's publication, *Construction Planning and Scheduling* (Associated General Contractors of America, January 1994).

Corps of Engineers Guide Specification 01310, *Project Schedule* (December 1994).

East, E. William, *A Guide to Computerized Scheduling* (Van Nostrand Rienhold, 1990).

East, E. William, Jeffrey G. Kirby, and Simon S. Kim, Project Management Systems Data Exchange Format: FY - 89 CENQAT Test Results, USACERL letter report (November 1989).

Engineer Regulation 1-1-11, Progress, Schedules, and Network Analysis Systems (Headquarters, U.S. Army Corps of Engineers [HQUSACE], 15 March 1990).

Gillian, Howard (Acting Chief, Kansas City Construction Division), personal correspondence to USACERL CECER-FS (30 June 1989).

Hall, Daniel F. (Chief, Construction Division), Corpsmail to CECER-FS (6 July 1989).

Kiper, J.E. (Chief, Ohio River Construction-Operations Division), personal correspondence to CECER-FS (20 June 1989).

Schmidt, Jacob H. (Acting Chief, North Pacific Construction-Operations Division), personal correspondence to E. William East, CECER-FS (28 June 1989).

U.S. Army Engineer Division, Huntsville, *Network Analysis Systems* (1985).

Workshop handouts for Format Workshop, 15-16 September 1988.

Appendix A: Draft SDEF Specification

STANDARD DATA EXCHANGE FORMAT SPECIFICATION

1 SEP 1995

PART 1 - GENERAL

1. Application of This Provision: The Standard Data Exchange Format (SDEF) provides a non-proprietary protocol to exchange project planning and progress data between scheduling systems.

2. File Type and Format: The data file shall consist of a 132 character, fixed format, "ASCII" file. Text shall be left-justified and numbers shall be right-justified in each field. Data records must conform, exactly, to the sequence, column position, maximum length, mandatory values, and field definitions described below to comply with the SDEF. Unless specifically stated, all numbers shall be whole numbers. Fields containing numbers shall not be zero filled. All data columns shall be separated by a single blank column. The file shall not contain blank lines.

3. Usage Notes: Where appropriate, notes regarding proper usage of systems to support the SDEF have been included in brackets ([]). These notes are included to assist users in creating SDEF-compatible files, given the variety of software systems that support the SDEF.

4. SDEF Checker Program: A program that checks whether a file meets the SDEF is available free of charge. A copy of this program may be obtained by written request to: U.S. Army Corps of Engineers, ATTN: Mr. Bill East (CECER-FFA), P.O. Box 9005, Champaign, IL 61826-90005. A description of the SDEF Checker will be made available on the Internet and CivilNet.

PART 2 - SDEF SPECIFICATION

5. SDEF Organization: The SDEF shall consist of the following records provided in the exact sequence shown below:

<u>Paragraph Reference</u>	<u>Record Description</u>	<u>Remarks</u>
5.a	Volume Record	Mandatory First Line of File
5.b	Project Record	Mandatory Second Line of File
5.c	Calendar Record(s)	Mandatory One Record Minimum
5.d	Holiday Record(s)	Mandatory if Holidays Used
5.e	Activity Record(s)	Mandatory Records
5.f	Precedence Record(s)	Mandatory for Precedence
5.g	Unit Cost Record(s)	Mandatory for Unit Costs
5.h	Progress Record(s)	Mandatory Records
5.I	File End Record	Mandatory Last Line of Disk/File

5.a. Volume Record: The Volume Record shall be used to control the transfer of data that may not fit on a single disk. The first line in every file used to store SDEF data shall be the Volume Record. The Volume Record shall sequentially identify the number of the data transfer disk(s). The Volume Record shall have the following format:

<u>Description</u>	<u>Column Position</u>	<u>Max. Len.</u>	<u>Req. Value</u>	<u>Type</u>	<u>Notes</u>
RECORD IDENTIFIER	1 - 4	4	VOLM	Fixed	Filled
DISK NUMBER	6 - 7	2	✓	Number	Right Justified

5.a.(1) The RECORD IDENTIFIER is the first four characters of this record. The required value for this field shall be "VOLM". The VOLM record must appear on the first line of the SDEF data file.

5.a.(2) The DISK NUMBER field shall identify the number of the data disk used to store the data exchange information. If all data may be contained on a single disk, this field shall contain the value of "1". If more disks are required, then the second disk shall contain the value "2", the third disk shall be designated with a "3", and so on. Identification of the last data disk is accomplished in the Project End Record.

5.b. Project Record: The Project Identifier Record shall contain general project information. Because more than one SDEF file may be required for data transfer between large projects, the PROJ record shall be the second line of the first SDEF file transferred. The PROJ record shall contain information in the following format:

<u>Description</u>	<u>Column Position</u>	<u>Max. Len.</u>	<u>Req. Value</u>	<u>Type</u>	<u>Notes</u>
RECORD IDENTIFIER	1 - 4	4	PROJ	Fixed	Filled
DATA DATE	6 - 12	7	✓	ddmmmyy	Filled
PROJECT IDENTIFIER	14 - 17	4	✓	Alpha.	Left Justified
PROJECT NAME	19 - 66	48	✓	Alpha.	Left Justified
CONTRACTOR NAME	68 - 103	36	✓	Alpha.	Left Justified
ARROW OR PRECEDENCE	105 - 105	1	A, P	Fixed	Filled
CONTRACT NUMBER	107 - 112	6	✓	Alpha.	Left Justified
PROJECT START	114 - 120	7	✓	ddmmmyy	Filled
PROJECT END	122 - 128	7	✓	ddmmmyy	Filled

5.b.(1) The RECORD IDENTIFIER is the first four characters of this record. The required value for this field shall be "PROJ". This record shall contain the general project information and indicates which scheduling method shall be used.

5.b.(2) The DATA DATE is the date of the schedule calculation. The abbreviation "ddmmmyy" refers to a date format that shall translate a date into two numbers for the day, three letters for the month, and two numbers for the year. For example, March 1, 1999 shall be translated into 01Mar99. This same convention for date formats shall be used throughout the entire data format. To ensure that dates are translated consistently, the following abbreviations shall be used for the three character month code:

<u>Abbreviation</u>	<u>Month</u>
JAN	January
FEB	February
MAR	March
APR	April
MAY	May
JUN	June
JUL	July

AUG	August
SEP	September
OCT	October
NOV	November
DEC	December

5.b.(3) The PROJECT IDENTIFIER is a maximum four character abbreviation for the schedule. These four characters shall be used to uniquely identify the project and specific update as agreed upon by Contractor and Contracting Officer. When utilizing scheduling software these four characters shall be used to select the project. Software manufacturers shall provide information to users to ensure that data importing programs do not automatically overwrite other schedules with the same PROJECT IDENTIFIER.

5.b.(4) The PROJECT NAME field shall contain the name and location of the project edited to fit the space provided. The data appearing here shall appear on scheduling software reports. The abbreviation "Alpha." refers to an "Alphanumeric" field value and shall be used throughout the remainder of this specification.

5.b.(5) The CONTRACTOR NAME field shall contain the Construction Contractor's name, edited to fit the space provided.

5.b.(6) The ARROW OR PRECEDENCE field shall indicate which method shall be used for calculation of the schedule. The value "A" shall signify the Arrow Diagramming Method. The value "P" shall signify the Precedence Diagramming Method. The ACTIVITY ID field of the Activity Record shall be interpreted differently depending on the value of this field. The Precedence Record shall be required if the value of this field is "P". [Usage note: software systems may not support both arrow and precedence diagramming. It is recommended that the selection of the type of network be based on the capabilities of the software used by project partners.]

5.b.(7) The CONTRACT NUMBER field shall contain the contract number for the project. For example, the construction contract number DACA85-89-C-0001 shall be entered into this field as "890001".

5.b.(8) The PROJECT START field shall contain the date that the Contractor acknowledges the Notice to Proceed (NTP). [Usage note: Software systems may use a project start date to constrain the first activity of a network. To ensure consistent scheduling calculations across products, it is recommended that the first activity in the schedule contain an EARLY START constraint and a software system's PROJECT START date only be used to report on the project's start date.]

5.b.(9) The PROJECT END field shall contain the date that the Contractor plans to complete the work as approved by the Contracting Officer. [Usage note: software systems may use a project end date to constrain the last activity of a network. To ensure consistent scheduling calculations across products, it is recommended that the last activity in the schedule contain an EARLY START constraint and a software system's PROJECT END date only be used to report on the project's end date.]

5.c. Calendar Record: The Calendar Record(s) shall follow the Project Identifier Record in the first disk of data transferred. A minimum of one Calendar Record shall be required for all data exchange activity files. The format for the Calendar Record shall be as follows:

<u>Description</u>	<u>Column Position</u>	<u>Max. Len.</u>	<u>Req. Value</u>	<u>Type</u>	<u>Notes</u>
RECORD IDENTIFIER	1 - 4	4	CLDR	Fixed	Filled
CALENDAR CODE	6 - 6	1	✓	Alpha.	Filled
WORKDAYS	8 - 14	7	SMTWTFS	Fixed	Filled
CALENDAR DESCRIPTION	16 - 45	30	✓	Alpha.	Left Justified

5.c.(1) The RECORD IDENTIFIER shall always begin with "CLDR" to identify it as a Calendar Record. Each Calendar Record used shall have this identification in the first four columns. [Usage note: Systems contain a variety of calendar options. It is recommended that the least common denominator of calendar features between the systems be used as the basis for creating the SDEF file for a given project.]

5.c.(2) The CALENDAR CODE shall be used in the activity records to signify that this calendar is associated with the activity. [Usage note: Some systems do not allow for alphanumeric CALENDAR CODES, but only allow positive integers from 1 to 9. It is recommended that only positive integers be used for the CALENDAR CODE field to support the widest variety of scheduling systems.]

5.c.(3) The WORKDAYS field shall contain the work-week pattern selected with "Y", for Yes, and "N", for No. The first character shall be Sunday and the last character Saturday. An example of a typical five (5) day work-week would be NYYYYYN. A seven (7) day work-week would be YYYYYYY.

5.c.(4) The CALENDAR DESCRIPTION shall be used to briefly describe the calendar used.

5.d. Holiday Record: The Holiday Record(s) shall follow the Calendar Record(s) in the first disk of data transferred. There may be calendars without any holidays designated or several Holiday Records for each Calendar Record(s). The format for the Holiday Record shall be as follows:

<u>Description</u>	<u>Column Position</u>	<u>Max. Len.</u>	<u>Req. Value</u>	<u>Type</u>	<u>Notes</u>
RECORD IDENTIFIER	1 - 4	4	HOLI	Fixed	Filled
CALENDAR CODE	6 - 6	1	✓	Alpha.	Filled
HOLIDAY DATE	8 - 14	7	✓	ddmmmyy	Filled
HOLIDAY DATE	16 - 22	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	24 - 30	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	32 - 38	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	40 - 46	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	48 - 54	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	56 - 62	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	64 - 70	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	72 - 78	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	80 - 86	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	88 - 94	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	96 - 102	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	104 - 110	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	112 - 118	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	120 - 126	7	-	ddmmmyy	May be Filled

5.d.(1) The RECORD IDENTIFIER shall always begin with "HOLI". Each Holiday Record used shall have this identification in the first four columns.

5.d.(2) The CALENDAR CODE indicates which work-week calendar the holidays shall be applied to. More than one HOLI record may be used for a given CALENDAR CODE.

5.d.(3) The HOLIDAY DATE shall contain the date of each individual non-work day.

5.e. Activity Records: Activity Records shall follow any Holiday Record(s). If there are no Holiday Record(s), then the Activity Records shall follow the Calendar Record(s). There shall be one Activity Record for every activity in the network. Each activity shall have one record in the following format:

<u>Description</u>	<u>Column Position</u>	<u>Max. Len.</u>	<u>Req. Value</u>	<u>Type</u>	<u>Notes</u>
RECORD IDENTIFIER	1 - 4	4	ACTV	Fixed	Filled
ACTIVITY ID	6 - 15	10	✓	Integer	See Comment Below
ACTIVITY DESCR.	17 - 46	30	✓	Alpha.	Left Justified
ACTIVITY DURATION	48 - 50	3	✓	Integer	Right Justified
CONSTRAINT DATE	52 - 58	7	-	ddmmmyy	May be Filled
CONSTRAINT TYPE	60 - 61	2	-	ES or LF	May be Filled
CALENDAR CODE	63 - 63	1	✓	Alpha.	Filled
HAMMOCK CODE	65 - 65	1	Y, blank	Fixed	May be Filled
WORKERS PER DAY	67 - 69	3	-	Integer	Right Justified
RESPONSIBILITY CODE	71 - 74	4	-	Alpha.	Left Justified
WORK AREA CODE	76 - 79	4	-	Alpha.	Left Justified
MOD OR CLAIM NO	81 - 86	6	-	Alpha.	Left Justified
BID ITEM	88 - 93	6	-	Alpha.	Left Justified
PHASE OF WORK	95 - 96	2	-	Alpha.	Left Justified
CATEGORY OF WORK	98 - 98	1	-	Alpha.	May be Filled
FEATURE OF WORK	100 - 128	30	-	Alpha.	Left Justified

5.e.(1) The RECORD IDENTIFIER for each activity description record must begin with the four character "ACTV" code. This field shall be used for both the Arrow Diagram Method (ADM) and Precedence Diagram Method (PDM).

5.e.(2) The ACTIVITY ID consists of coding that shall differ, depending on whether the ADM or PDM method was selected in the Project Record. If the ADM method was selected, then the field shall be interpreted as two right-justified fields of five (5) integers each. If the PDM method was selected, the field shall be interpreted as one (1) right-justified field of ten (10) integers each. The maximum activity number allowed under this arrangement is 99999 for ADM and 9999999999 for the PDM method. [Usage note: Many systems allow alphanumeric ACTIVITY IDs. While the SDEF does not, strictly, allow the use of alphanumeric values, users may agree to use the ACTIVITY ID field to exchange alphanumeric data. It is recommended that the ACTIVITY ID be restricted to integers when one or more of the systems being used for scheduling allows only integer ACTIVITY ID values.]

5.e.(3) The ACTIVITY DESCRIPTION shall be a maximum of 30 characters. Descriptions must be limited to the space provided.

5.e.(4) The ACTIVITY DURATION contains the estimated original duration for the activity on the schedule. The duration shall be based upon the work-week designated by the activity's related calendar.

5.e.(5) The CONSTRAINT DATE field shall be used to identify a date that the scheduling system may use to modify float calculations. If there is a date in this field, then there must be a valid entry in the CONSTRAINT TYPE field.

5.e.(6) The CONSTRAINT TYPE field shall be used to identify the way that the scheduling system shall use the CONSTRAINT DATE to modify schedule float calculations. If there is a value in this field, then there must be a valid entry in the CONSTRAINT DATE field. The valid values for the CONSTRAINT TYPE are as follows:

<u>Code</u>	<u>Definition</u>
ES	The CONSTRAINT DATE shall replace an activity's early start date, if the early start date is prior to the CONSTRAINT DATE.
LF	The CONSTRAINT DATE shall replace an activity's late finish date, if the late finish date is after the CONSTRAINT DATE.

[Usage note: Systems provide a wide variety of constraint types that may not be supported by other systems. It is recommended that constraint types be restricted to the values above regardless of the capabilities of the various systems being used for scheduling.]

5.e.(7) The CALENDAR CODE relates this activity to an appropriate work-week calendar. The ACTIVITY DURATION must be based on the valid work-week referenced by this CALENDAR CODE field.

5.e.(8) The HAMMOCK CODE indicates that a particular activity does not have its own independent duration, but takes its start dates from the start date of the preceding activity (or node) and takes its finish dates from the finish dates of its succeeding activity (or node). If the value of the HAMMOCK CODE field is "Y", then the activity is a hammock activity.

5.e.(9) The WORKERS PER DAY shall contain the average number of workers expected to work on the activity each day the activity is in progress. If this code is required by project scheduling specifications, values for this data will be right justified. Activities without workers per day shall have a value of "0".

[Usage note: The codes described in paragraphs 5.e.(10) through 5.e.(16) are commonly referred to as activity codes.]

5.e.(10) The RESPONSIBILITY CODE shall identify the subcontractors or major trade involved with completing the work for the activity. If this code is required by project scheduling specifications, value for this data will be left justified.

5.e.(11) The WORK AREA CODE shall identify the location of the activity within the project. If this code is required by project scheduling specifications, value for this data will be left justified.

5.e.(12) The MOD OR CLAIM NUMBER shall uniquely identify activities that are added or changed on a construction contract modification, or activities that justify any claimed time extensions. If this code is required by project scheduling specifications, value for this data will be left justified.

5.e.(13) The BID ITEM shall identify the bid item number associated with each activity. If this code is required by project scheduling specifications, value for this data will be left justified.

5.e.(14) The PHASE OF WORK shall identify the timing of a specific activity within the entire project. If this code is required by project scheduling specifications, value for this data will be left justified.

5.e.(15) The CATEGORY OF WORK shall identify the general type of work performed by every activity. If this code is required by project scheduling specifications, value for this data will be placed in the field.

5.e.(16) The FEATURE OF WORK shall identify a very broad designation of the general type of work that is being accomplished by the activity. If this code is required by project scheduling specifications, value for this data will be left justified. [Usage note: Many systems require that FEATURE OF WORK values be placed in several activity code fields. It is recommended that users review SDEF documentation to determine the correct way to use a given software system to produce the FEATURE OF WORK code.]

5.f. Precedence Record: The Precedence Record(s) shall follow the Activity Records if a Precedence Diagram Method schedule (PDM) is identified in the ARROW OR PRECEDENCE field of the Project Record. The Precedence Record has the following format:

<u>Description</u>	<u>Column Position</u>	<u>Max. Len.</u>	<u>Req. Value</u>	<u>Type</u>	<u>Notes</u>
RECORD IDENTIFIER	1 - 4	4	PRED	Fixed	Filled
ACTIVITY ID	6 - 15	10	✓	Integer	See Comment Below
PRECEDING ACTIVITY	17 - 26	10	✓	Integer	See Comment Below
PREDECESSOR TYPE	28 - 28	1	✓	S, F, C	Filled
LAG DURATION	30 - 33	4	✓	Integer	Right Justified

5.f.(1) The RECORD IDENTIFIER shall begin with the four characters "PRED" in the first four columns of the record.

5.f.(2) The ACTIVITY ID identifies the activity whose predecessor shall be specified in this record.

5.f.(3) The PRECEDING ACTIVITY number is the number of an activity that precedes the activity noted in the ACTIVITY ID field.

5.f.(4) The PREDECESSOR TYPE field indicates the type of relation that exists between the chosen pair of activities. Valid PREDECESSOR TYPE fields are as follows:

<u>Code</u>	<u>Definition</u>
S	Start-to-Start relation
F	Finish-to-Finish relation
C	Finish-to-Start relation

[Usage note: Some systems provide additional predecessor types that may not be supported by all other systems. It is recommended that predecessor types be restricted to the values above regardless of the capabilities of the various systems being used for scheduling.]

5.f.(5) The LAG DURATION field contains the number of days delay between the preceding and current activity. [Usage note: Some systems allow negative values for the LAG DURATION. Because these values are not supported by all other systems, it is recommended that values be restricted to zero and positive integers.]

5.g. Unit Cost Record: The Unit Cost Record shall follow all Precedence Records. If the schedule utilizes the Arrow Diagram Method, then the Unit Cost

Record shall follow any Activity records. There shall be one Unit Cost Record for every activity that is not a lump sum activity. [Usage note: (1) It is recommended that users who wish to exchange unit cost data contact SDEF vendor representatives to determine the ability of the software system to import/export unit cost information. (2) If the software being used by each member of the project team supports unit cost data, then users may wish to conduct a trial run of the SDEF data exchange with a two- or three-activity network to ensure that unit cost data transfers as expected. If problems are found, please consult vendor representatives for resolution prior to exchange of full project schedules. (3) Unit cost record data does not, in most systems, result in the correct values being placed in the ACTIVITY COST and COST TO DATE fields of the Progress (PROG) Record. Users must, at this time, manually transfer the data from the Unit Cost Record to the Progress Record.

The fields for this record shall take the following format:

<u>Description</u>	<u>Column Position</u>	<u>Max. Len.</u>	<u>Req. Value</u>	<u>Type</u>	<u>Notes</u>
RECORD IDENTIFIER	1 - 4	4	UNIT	Fixed	Filled
ACTIVITY ID	6 - 15	10	✓	Integer	See Comment Below
TOTAL QTY	17 - 29	13	✓	Format 8.4	Right Justified
COST PER UNIT	31 - 43	13	✓	Format 8.4	Right Justified
QTY TO DATE	45 - 57	13	✓	Format 8.4	Right Justified
UNIT OF MEASURE	59 - 61	3	✓	Alpha.	Left Justified

5.g.(1) The RECORD IDENTIFIER shall be identified with the four characters "UNIT" placed in the first four columns of the record.

5.g.(2) The ACTIVITY ID for each activity shall match the format described in the activity record. Each activity may have only one Unit Cost Record.

5.g.(3) The TOTAL QTY is the total amount of material to be used in this activity. This number consists of eight digits, one decimal point, and four more digits. An example of a number in this format is "1111111.1111". If decimal places are not needed this field shall still contain a ".0000" in columns 25 - 29. [Usage note: Many systems support a different format for this value that does not include as many decimal places. It is recommended that users determine their requirements for significant digits based on the lowest common denominator of the software systems being used for a given project.]

5.g.(4) The COST PER UNIT is the cost, in dollars and cents, for each unit to be used in this activity. This number consists of eight digits, one decimal point, and four more digits. An example of a number in this format is "1111111.1111". If decimal places are not needed, this field shall still contain a ".0000" in columns 39 - 43. [Usage note: Many systems support a different format for this value that does not include as many decimal places. It is recommended that users determine their requirements for significant digits based on the lowest common denominator of the software systems being used for a given project.]

5.g.(5) The QTY TO DATE is the quantity of material installed in this activity up to the data date. This number consists of eight digits, one decimal point, and four more digits. An example of a number in this format is "1111111.1111". If decimal places are not needed, this field shall still contain a ".0000" in columns 53 - 57. [Usage note: Many systems support a different format for this value that does not include as many decimal places. It is recommended that users determine their requirements for significant digits based on the lowest common denominator of the software systems being used for a given project.]

5.g.(6) The UNIT OF MEASURE is an abbreviation that may be used to describe the units being measured for this activity. Valid values for this field are any meaningful English or metric unit, except "LS" for Lump Sum. Lump Sum activities are not to have Unit Cost Records.

5.h. Progress Record: Progress Record(s) shall follow all Unit Cost Record(s). If there are no Unit Cost Record(s), then the Progress Record(s) shall follow all Precedence Records. If the schedule utilizes the Arrow Diagram Method, then the Progress Record shall follow any Activity Records. One Progress Record is required for every activity in the Activity Record. The fields for this Record shall be provided in the following format:

<u>Description</u>	<u>Column</u>	<u>Max.</u>	<u>Req.</u>	<u>Type</u>	<u>Notes</u>
	<u>Position</u>	<u>Len.</u>	<u>Value</u>		
RECORD IDENTIFIER	1 - 4	4	PROG	Fixed	Filled
ACTIVITY ID	6 - 5	10	✓	Integer	See Comment Below
ACTUAL START DATE	17 - 23	7	✓	ddmmmyy	Filled if Started
ACTUAL FINISH DATE	25 - 31	7	✓	ddmmmyy	Filled if Finished
REMAINING DURATION	33 - 35	3	✓	Integer	Right Justified
ACTIVITY COST	37 - 48	12	✓	Format 9.2	Right Justified
COST TO DATE	50 - 61	12	✓	Format 9.2	Right Justified
STORED MATERIAL	63 - 74	12	✓	Format 9.2	Right Justified

EARLY START DATE	76 - 82	7	✓	ddmmyy	Filled if Not Started
EARLY FINISH DATE	84 - 90	7	✓	ddmmyy	Filled if Not Finished
LATE START DATE	92 - 98	7	✓	ddmmyy	Filled if Not Started
LATE FINISH DATE	100 - 106	7	✓	ddmmyy	Filled if Not Finished
FLOAT SIGN	108 - 108	1	+, -	Fixed	Filled if Not Finished
TOTAL FLOAT	110 - 112	3	✓	Integer	Right Just. if Not Finished

5.h.(1) The RECORD IDENTIFIER shall begin with the four characters "PROG" in the first four columns of the record.

5.h.(2) The ACTIVITY ID for each activity for which progress has been posted shall match the format described in the Activity Record.

5.h.(3) An ACTUAL START DATE is required for all in-progress activities. The ACTUAL START DATE shall be the same as, or later than, the PROJECT START date contained in the Project Record. The ACTUAL START DATE shall also be the same as, or prior to, the DATA DATE contained in the Project Record. If there is an ACTUAL START DATE for an activity that there must also be a REMAINING DURATION, and the values for the EARLY START DATE and LATE START DATE are blank. [Usage note: Some systems allow default values for ACTUAL START DATE if the date is not entered by the user. Because the failure to include a start date for activities may result in different schedule calculations, it is recommended that the ACTUAL START DATE be required for all activities in progress.]

5.h.(4) An ACTUAL FINISH DATE is required for all completed activities. If the REMAINING DURATION of an activity is zero, then there must be an ACTUAL FINISH DATE. If there is an ACTUAL FINISH DATE, then values for the EARLY START DATE, LATE START DATE, EARLY FINISH DATE, LATE FINISH DATE, FLOAT SIGN, and TOTAL FLOAT shall be blank. [Usage note: Some systems allow default values for ACTUAL FINISH DATE if the date is not entered by the user. Because the failure to include a finish date for activities may result in different schedule calculations, it is recommended that the ACTUAL FINISH DATE be required for all activities in progress.]

5.h.(5) A REMAINING DURATION is required for all activities. Activities that have not started shall have a remaining duration equal to their original duration. Activities completed, based on time, shall have a zero (0) REMAINING DURATION. [Usage note: Systems have a variety of "short-cut" methods to determine the REMAINING DURATION value. It is recommended that users actually consider the time required to complete the remaining work on a given task, rather than allow a

system to calculate the remaining duration based on the amount of work that has already been accomplished.]

5.h.(6) The ACTIVITY COST contains the estimated earned value of the work to be accomplished in the activity. An example of a number in this format is "11111111.11". If decimal places are not needed, this field shall still contain a ".00" in the last three columns of this field. [Usage note: Users should inquire of software vendors if the user needs to add a zero in the data field to produce the default value "0.00".]

5.h.(7) The COST TO DATE contains the earned value for the activity. If there is an ACTUAL START DATE, then there must also be some value for COST TO DATE. An example of a number in this format is "11111111.11". If decimal places are not needed, this field shall still contain a ".00" in the last three columns of this field. The COST TO DATE is not tied to REMAINING DURATION. For example, if the REMAINING DURATION is "0", the COST TO DATE may only be 95 percent of the ACTIVITY COST. This difference may be used to reflect 5 percent retainage for punch list items. [Usage note: Systems implement cost information in different ways. It is recommended that users carefully review SDEF documentation and test results to determine how to ensure that SDEF data is exported correctly.]

5.h.(8) The STORED MATERIAL field contains the value of the material that the Contractor has paid for and is on site or in secure storage areas that is a portion of the COST TO DATE. An example of a number in this format is "11111111.11". If decimal places are not needed, this field shall still contain a ".00" in the last three columns of this field. [Usage note: Systems implement the stored materials field in a variety of ways. Many systems do not enforce STORED MATERIAL + COST TO DATE < ACTIVITY COST. To avoid potential confusion between systems, it is recommended that new activities be added to a schedule to reflect the cost of large equipment procurement rather than use the STORED MATERIALS field.]

Recommendations for changes to these products for enhanced compatibility with the SDEF are presented in each product's respective Appendix 5.h.(9) The EARLY START DATE indicates the earliest date possible that an activity can start as calculated by a CPM scheduling system or other Contracting Officer approved planning method. If the progress record for an activity contains an ACTUAL START DATE, then this field shall be blank.

5.h.(10) The EARLY FINISH DATE indicates the earliest date possible that an activity can finish as calculated by a CPM scheduling system or other Contracting

Officer approved planning method. If the progress record for an activity contains an ACTUAL FINISH DATE, then this field shall be blank.

5.h.(11) The LATE START DATE indicates the latest date that an activity can begin as calculated by a CPM scheduling system or other Contracting Officer approved planning method. If the progress record for an activity contains an ACTUAL START DATE, then this field shall be blank.

5.h.(12) The LATE FINISH DATE indicates the latest date that an activity can finish as calculated by a CPM scheduling system or other Contracting Officer approved planning method. If the progress record for an activity contains an ACTUAL FINISH DATE, then this field shall be blank.

5.h.(13) The FLOAT SIGN indicates whether the float time calculated, using a CPM scheduling system or other Contracting Officer approved planning method, is positive or negative in nature. If the progress record for an activity contains an ACTUAL FINISH DATE, then this field shall be blank. In the case of zero float this field shall be blank.

5.h.(14) The TOTAL FLOAT indicates the total float time. In the Precedence Diagram Method (PDM), the total float is the difference between the early and late start or finish dates. In the Arrow Diagram Method (ADM), the total float is equal to the late event time at the end of the activity, minus the sum of the early event time at the start of the activity plus the duration of the activity.

5.i. Project End Record: The Project End Record shall be used to identify that the data file is completed. If the ASCII End of File character is encountered, then data import programs shall use that character to infer that the data continues on the next disk. The user shall then be prompted for the next disk number, based on the VOLM record data. The Project End Record shall be the last record of the entire data file, and shall have the following format:

<u>Description</u>	<u>Column Position</u>	<u>Max. Len.</u>	<u>Req. Value</u>	<u>Type</u>	<u>Notes</u>
RECORD IDENTIFIER	1 - 3	3	END	Fixed	Filled

5.i.(1) The RECORD IDENTIFIER for the Project End Record shall be "END". Data contained in the data exchange file that occurs after this record shall not be used.

Appendix B: July 1994 Test Personnel

Name	Address	Telephone/Fax
Dave Balding	U.S. Army, Corps of Engineers Denver Resident Office P.O. Box 1865 Commerce City, CO 80037-1865	(303) 286-1910 FAX: (303) 286-1964
Haskell Barker	U.S. Army Engineer District, Los Angeles Fort Irwin Area Office P.O. Box 10048 Fort Irwin, CA 92310-0048	(619) 380-4020 FAX (619) 380-2497
Stan Green	Commander, U.S. Army Corps of Engineers ATTN: Mr. Stan Green, CEMP-CE 20 Massachusetts Ave., N.W. Washington, D.C. 20314-1000	(202) 272-0206 FAX:(202) 504-4783
Steve Hoyle	U.S. Army, Corps of Engineers P.O. Box 4872 Patrick AFB, Florida 32925-7428	(407) 494-2971 FAX: (407) 494-2081
Dennis Newell	U.S. Army, Corps of Engineers Florida Area Office MAILSTOP COE Patrick AFB, Florida 32925-7428	(407) 853-7822 FAX: (407) 853-3154
Norm Sams	U.S. Army, Corps of Engineers Fairbanks Resident Office P.O. Box 35066 Fort Wainwright, AK 99703	(907) 353-7062 FAX: (907) 353-7556

Glen Stinn	U.S. Army Engineer District, Omaha 215 N. 17th Street Omaha, NE 68102-4978	(402) 221-4166 FAX: (402) 221-3030
Dick Szabo	U.S. Army Engineer District, Savannah P.O. Box 889 Savannah, GA 31402-0889	(912) 652-5235 FAX: (912) 652-5121
Anita Thomas	NASA, STOP MS-356 Langley Research Center	(804) 864-7004 FAX: (804) 864-7890

Appendix C: July 1994 Questionnaire

1. Is the SDEF specifically noted in the Table of Contents ? Yes / No
2. If there is no specific section on the SDEF is there a general discussion of data import and export routines that includes the SDEF ? Yes / No
3. Is the SDEF specifically noted in the Index ? Yes / No / No Index
4. In what Section or Chapter does the SDEF material appear:
5. On what page(s) does the SDEF material appear:
6. Is there separate discussion of SDEF import ? Yes / No
 - 6a. Does the system support SDEF import ? Yes / No (page #:)
 - 6b. Are there specific discussions about what data fields are supported for SDEF import and what fields are not supported ? Yes / No (page #:)
 - 6c. If there are specific discussions about what data fields are supported for SDEF import, please circle any of the following items that are noted in the documentation and provide page numbers.
 - (1) Arrow or Precedence Notation ? Yes / No / Not Described (page #:)
 - (2) Project Start and End Dates ? Yes / No / Not Described (page #:)
 - (3) Multiple Calendars ? Yes / No / Not Described (page #:)
 - (4) Holiday Dates ? Yes / No / Not Described (page #:)
 - (5) Activity Milestones or Constraints? Yes / No / Not Described (page #:)
 - (6) Hammock Activities ? Yes / No / Not Described (page #:)
 - (7) Workers Per Day Code ? Yes / No / Not Described (page #:)
 - (8) Responsibility Code ? Yes / No / Not Described (page #:)
 - (9) Work Area Code ? Yes / No / Not Described (page #:)
 - (10) Mod or Claim Number ? Yes / No / Not Described (page #:)
 - (11) Bid Item ? Yes / No / Not Described (page #:)

- (12) Phase of Work ? Yes / No / Not Described (page #:)
- (13) Category of Work ? Yes / No / Not Described (page #:)
- (14) Feature of Work ? Yes / No / Not Described (page #:)
- (15) Types of Lags in Precedence ? Yes / No / Not Described (page #:)
- (16) Unit Cost ? Yes / No / Not Described (page #:)
- (17) Budgeted Earned Value ? Yes / No / Not Described (page #:)
- (18) Remaining Duration? Yes / No / Not Described (page #:)
- (19) Cost to Date ? Yes / No / Not Described (page #:)

6d. If the system supports SDEF import, do the manuals explain procedures to set the system's default values for the SDEF import ? Yes / No (page #:)

6e. If the system supports SDEF import, does the system automatically set up the SDEF default values for the SDEF import ? Yes / No (page #:)

7. Is there separate discussion of SDEF export ? Yes / No

7a. Does the system support SDEF export ? Yes / No (page #:)

7b. Are there specific discussions about what data fields are supported for SDEF export and what fields are not supported ? Yes / No (page #:)

7c. If there are specific discussions about what data fields are supported for SDEF export, please circle any of the following items that are noted in the documentation and provide page numbers.

- (1) Arrow or Precedence Notation ? Yes / No / Not Described (page #:)
- (2) Project Start and End Dates ? Yes / No / Not Described (page #:)
- (3) Multiple Calendars ? Yes / No / Not Described (page #:)
- (4) Holiday Dates ? Yes / No / Not Described (page #:)
- (5) Activity Milestones or Constraints ? Yes / No / Not Described (page #:)
- (6) Hammock Activities ? Yes / No / Not Described (page #:)
- (7) Workers Per Day Code ? Yes / No / Not Described (page #:)
- (8) Responsibility Code ? Yes / No / Not Described (page #:)
- (9) Work Area Code ? Yes / No / Not Described (page #:)
- (10) Mod or Claim Number ? Yes / No / Not Described (page #:)
- (11) Bid Item ? Yes / No / Not Described (page #:)
- (12) Phase of Work ? Yes / No / Not Described (page #:)
- (13) Category of Work ? Yes / No / Not Described (page #:)
- (14) Feature of Work ? Yes / No / Not Described (page #:)
- (15) Types of Lags in Precedence ? Yes / No / Not Described (page #:)
- (16) Unit Cost ? Yes / No / Not Described (page #:)

(17) Budgeted Earned Value ? Yes / No / Not Described (page #:)

(18) Remaining Duration ? Yes / No / Not Described (page #:)

(19) Cost to Date ? Yes / No / Not Described (page #:)

7d. If the system supports SDEF export, do the manuals explain procedures to set the system's default values for the SDEF export ? Yes / No (page #:)

7e. If the system supports SDEF export, does the system automatically set up the SDEF default values for the SDEF export ? Yes / No (page #:)

Appendix D: AlderGraf, Version 5.2

The custom version of the system tested, which included additional files and instructions, met the SDEF specifications for creating SDEF files and is recommended for use by Contractors and Corps of Engineers offices for this use. Use of the system to *import* SDEF-compatible files is not recommended at this time due to errors found while importing actual cost data. Before using the AlderGraf system to export SDEF files, users should review the additional information found in this report.

The SDEF point of contact is Mr. Leon C. Alderfer, AlderGraf Systems, Inc., 10620 Stebbins Circle, Suite B, Houston, TX 77043; Telephone (713) 467-8500, FAX (713) 467-1062.

Installing the Software

- Did the program tested appear to be a distribution version of the software ? **Yes**

Version 5.2 is the distribution version of the system.

- Did the program require additional files not contained on the system disks ? **Yes**

Additional program disks were required. The vendor indicated that the recommended changes noted in this test report would be (1) available on a supplemental program disk to Version 5.2 and (2) incorporated into the next production version, Version 5.3, to be released 1 May 1995.

Creating an SDEF-Compatible Project

SDEF import and export routines are built into the program structure and are very easy to find and use. The routines provide prompts and quickly create the necessary files on a data disk (in the case of the export routine) or the new project (in the case of importing an SDEF file).

It is recommended that the SDEF documentation be included in the AlderGraf users manual. In addition, template projects should be provided with future versions of AlderGraf so that users do not have to modify data structures to meet SDEF requirements.

Once the software was installed, a sample project was created following the supplemental SDEF directions. The sample project was entered manually into the software system. SDEF output files generated through AlderGraf will be made available through anonymous ftp service through "ftp.cecer.army.mil". The files will be contained in the subdirectory "asce/sdef/files".

- Was SDEF documentation provided with the system ? **Yes**

Two text files that needed to be printed were contained on the supplemental data disk.

- Was SDEF documentation sufficient for easy creation of SDEF projects ? **Yes**

Supplemental SDEF documentation describes the process of creating files compatible with the SDEF format. This additional documentation explains how users must define the code structures that need to be changed in AlderGraf for the system to meet the SDEF requirements. Once the user creates a template project, the custom project may be used to create future SDEF projects without the need to customize AlderGraf data structures. While this process should be familiar to AlderGraf users, care must be exercised to follow the supplemental instructions exactly.

The following tables show how data should be formatted for each record. Comments guide the user in matching the product's data to the SDEF, and indicate any difficulties encountered or recommendations. In the **Req. Value** column, a check mark means that the data is required. For a dash (-) in the **Req. Value** column or "See spec" in the **Notes** column, check the explanation for that item in the draft SDEF specification (Appendix A).

Table D1. AlderGraf Volume Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	VOLM	Fixed	Filled	• Is VOLM record on line one (1) of the SDEF file produced for this system? Yes
DISK NUMBER	6 - 7	2	✓	Number	Right Justified	

Table D2. AlderGraf Project Record data.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1-4	4	PROJ	Fixed	Filled	None.
DATA DATE	6-12	7	✓	ddmmmyy	Filled	Corresponds to the "Update Date" field of the Schedule Dates Screen. If no date is provided there, DATA DATE is set to the value in the AlderGraf "Project Start Date" field.
PROJECT IDENTIFIER	14 - 17	4	✓	Alpha.	Left Justified	Corresponds to the "Project ID" field of the Schedule Information Screen. The first four characters of the "Project ID" field are used as the PROJECT IDENTIFIER, as noted in supplemental user documentation.
PROJECT NAME	19 - 66	48	✓	Alpha.	Left Justified	Corresponds to the "Project Name" field of the Schedule Information Screen.
CONTRACTOR NAME	68 - 103	36	✓	Alpha.	Left Justified	Corresponds to the "Company Name" field of the Schedule Information Screen.
ARROW OR PRECEDENCE	105 - 105	1	A, P	Fixed	Filled	Corresponds to the "Schedule Method" field of the Schedule Information Screen.
CONTRACT NUMBER	107 - 112	6	✓	Alpha.	Left Justified	Corresponds to the "Contract Nbr" field on the Schedule Information Screen. Supplemental user documentation, however, notes that the first six characters of the second line of the project name are used for the contract number. The program may have been updated after this supplemental documentation. It is recommended that revised SDEF documentation resolve this apparent mismatch between the system and the current documentation.
PROJECT START	114 - 120	7	✓	ddmmmyy	Filled	Corresponds to the "Project Start Date" field on the Schedule Dates Screen. Little testing was done to determine the impact of various combinations of activities with start date constraints and various project start dates. Because the "Project Start Date" field may affect schedule calculations, users should leave this field blank. It is recommended that revised SDEF documentation discuss the limitations on use of a PROJECT START date to constrain the CPM calculations.
PROJECT END	122 - 128	7	✓	ddmmmyy	Filled	Corresponds to the "End Date Current" field on the Summary Screen. Little testing was done to determine the impact of various combinations of activities with end date constraints and various project end dates. Because the "End Date Current" field may affect schedule calculations, users should leave this field blank. It is recommended that revised SDEF documentation discuss the limitations on use of a PROJECT END date to constrain the CPM calculations.

Table D3. AlderGraf Calendar Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	CLDR	Fixed	Filled	None.
CALENDAR CODE	6 - 6	1	✓	Alpha.	Filled	Corresponds to the "Calendar ID" field of the Define Calendar Screen. While the SDEF allows alphanumeric calendar codes, as does AlderGraf, certain scheduling systems do not allow letters for calendar codes. To accommodate these other vendors, calendar code values should be limited to numeric values. It is recommended that revised SDEF documentation note that values for calendar codes should only be values from 1 through 9. Note that the "Multiple Calendars" field of the Schedule Information Screen may limit the number of calendars available for a given project. Users familiar with the system should be able to address this issue. It is recommended that revised SDEF documentation discuss the need to set a value for the "Multiple Calendars" field.
WORKDAYS	8 - 14	7	SMTWTFS	Fixed	Filled	Corresponds to the "Work Week" field of the Define Calendar Screen.
CALENDAR DESCRIPTION	16 - 45	30	✓	Alpha.	Left Justified	Corresponds to the "Calendar Desc" field of the Define Calendar Screen.

Table D4. AlderGraf Holiday Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	HOLI	Fixed	Filled	None.
CALENDAR CODE	6 - 6	1	✓	Alpha.	Filled	Because holidays are developed concurrently with calendars, see comments regarding useful values for the CALENDAR CODE field in the Calendar Record (previous table).
HOLIDAY DATE	8 - 14	7	✓	ddmmmyy	Filled	No comments for any HOLIDAY DATE
HOLIDAY DATE	16 - 22	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	24 - 30	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	32 - 38	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	40 - 46	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	48 - 54	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	56 - 62	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	64 - 70	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	72 - 78	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	80 - 86	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	88 - 94	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	96 - 102	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	104 - 110	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	112 - 118	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	120 - 126	7	-	ddmmmyy	May be Filled	

Table D5. AlderGraf Activity Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	ACTV	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	Corresponds to the "Activity ID" field of the Add Activities Screen. The SDEF does not support AlderGraf alphanumeric activity identifiers. Alphanumeric data for this field may be used only if all members of the project use software that supports alphanumeric values; otherwise, ACTIVITY ID shall strictly comply with the SDEF. It is recommended that this caution be included in revised SDEF documentation. Users should be encouraged to obtain written approval for alphanumeric ACTIVITY IDs prior to creating the project schedule.
ACTIVITY DESCR.	17 - 46	30	✓	Alpha.	Left Justified	None.
ACTIVITY DURATION	48 - 50	3	✓	Integer	Right Justified	None.
CONSTRAINT DATE	52 - 58	7	-	ddmmmyy	May be Filled	None.
CONSTRAINT TYPE	60 - 61	2	-	ES or LF	May be Filled	Corresponds to either of the two "Constraints" fields in the Edit Activities Screen. The SDEF supports both types of AlderGraf constraints. Supplemental user documentation indicates that if both of these constraints are applied to a single activity, then only the start date constraint is exported. It is recommended that revised SDEF documentation indicate that only one type of constraint be used on a given activity. Activities with constraints that do not meet the SDEF requirements should be reported upon export, because these constraints may cause the schedule to calculate differently after subsequent importing to a different system.
CALENDAR CODE	63 - 63	1	✓	Alpha.	Filled	AlderGraf uses a specific activity type called a "Milestone Activity". No significant testing was done to determine if the Milestone Activity designation produces changes in scheduling calculation. It is recommended that revised SDEF documentation provide additional information on the impact of the Milestone Activity designation on the output of the CONSTRAINT TYPE field.
HAMMOCK CODE	65 - 65	1	Y, blank	Fixed	May be Filled	See comment under CALENDAR CODE in Table D3.
						None.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
WORKERS PER DAY	67 - 69	3	-	Integer	Right Justified	Supplemental user documentation describes how to add this resource code category. These instructions must be followed exactly to ensure that data exports correctly. Users may press ALT+L at the Edit Activities Screen to add codes (the Resource Library Screen may be used to add this resource). As an alternative to creating the resource code library, users are encouraged to copy a template project with predefined resource codes. Note that a value of zero does not export even if users directly enter zero in the WORKERS PER DAY field. It is recommended that the system allow the user to export a zero.
RESPONSIBILITY CODE	71 - 74	4	-	Alpha.	Left Justified	Supplemental user documentation describes how to add this activity code category. These instructions must be followed exactly to ensure that data is exported correctly. Users may press ALT+C at the Edit Activities Screen to add codes at the Code Library Screen. As an alternative to creating the activity code library for every project, users are encouraged to copy a template project with predefined activity codes. The best way to enter the data is by using the "Add Fields" feature at the Edit Activities Screen. Once all activity codes have been added, then the code fields may be removed from the screen and the cost related items added.
WORK AREA CODE	76 - 79	4	-	Alpha.	Left Justified	See comments under RESPONSIBILITY CODE.
MOD OR CLAIM NO.	81 - 86	6	-	Alpha.	Left Justified	See comments under RESPONSIBILITY CODE.
BID ITEM	88 - 93	6	-	Alpha.	Left Justified	See comments under RESPONSIBILITY CODE.
PHASE OF WORK	95 - 96	2	-	Alpha.	Left Justified	See comments under RESPONSIBILITY CODE.
CATEGORY OF WORK	98 - 98	1	-	Alpha.	May be Filled	See comments under RESPONSIBILITY CODE.
FEATURE OF WORK	100-128	30	-	Alpha.	Left Justified	See comments under RESPONSIBILITY CODE. Note that FEATURE OF WORK must be entered as two separate fields, as noted in supplemental documentation. The first field is 20 characters in length, the second 10 characters.

Table D6. AlderGraf Precedence Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	PRED	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	See comment in previous table regarding use of alphanumeric values.
PRECEDING ACTIVITY	17 - 26	10	✓	Integer	See Spec	Use or nonuse of alphanumeric characters should be guided by the same considerations as for ACTIVITY ID.
PREDECESSOR TYPE	28 - 28	1	✓	S, F, C	Filled	AlderGraf allows the Start-to-Finish PREDECESSOR TYPE that is not supported by the SDEF. The use of predecessor types that do not match the SDEF will result in inconsistent scheduling calculations between systems. It is recommended that revised SDEF documentation indicate that users cannot use the Start-to-Finish sequence type for SDEF projects. In the distribution version of the SDEF routines it is recommended that an error message be reported if the Start-to-Finish sequence is found.
LAG DURATION	30 - 33	4	✓	Integer	Right Justified	AlderGraf allows the use of negative values for LAG DURATION that is not supported by the SDEF. The use of negative lags will result in inconsistent scheduling calculation between systems. It is recommended that revised SDEF documentation indicate that users cannot use negative lags for SDEF projects. In the distribution version of the SDEF routines it is recommended that an error message should be reported if negative lags are found.

Table D8. AlderGraf Progress Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	PROG	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	See comment in Table D4 regarding use of alphanumeric values.
ACTUAL START DATE	17 - 23	7	✓	ddmmmyy	Filled if Started	If any progress is supplied without an ACTUAL START DATE, AlderGraf supplies one day prior to the DATA DATE. This is excellent, because the result is that even if a user is not sure of the ACTUAL START DATE, at least some value is provided for future reference.
ACTUAL FINISH DATE	25 - 31	7	✓	ddmmmyy	Filled if Finished	If a remaining duration of zero or a percent complete of 100 is provided without an ACTUAL FINISH DATE, AlderGraf supplies a date of one day prior to the DATA DATE. This is excellent, because the result is that even if the user is not sure of the ACTUAL START DATE at least some value is provided for future reference.
REMAINING DURATION	33 - 35	3	✓	Integer	Right Justified	Users may update either REMAINING DURATION or PERCENT COMPLETE. The PERCENT COMPLETE changes the COST TO DATE field and may also report remaining duration.
ACTIVITY COST	37 - 48	12	✓	Format 9.2	Right Justified	Supplemental user documentation describes HOW to add this AlderGraf resource code category. These instructions must be followed exactly to ensure that data is exported correctly. At the Edit Activities Screen, users may add codes by pressing ALT+L. The Resource Library Screen may be used to add this resource. As an alternative to creating the resource code library, users are encouraged to copy a template project with predefined resource codes. To obtain a zero value in the SDEF file, users must enter the value "0.01" in the data field. It is recommended that revised SDEF documentation explain that the one cent value must be entered to obtain a zero output. In the distribution version of the SDEF routines it is recommended that a default be provided.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
COST TO DATE	50 - 61	12	✓	Format 9.2	Right Justified	At the Edit Activities Screen, users may add this value by pressing ALT+P. The Resource Updating Screen has a "To-Date Amt." field that corresponds to the COST TO DATE. While the Resource Updating Screen has a "Pcnt" value, users should check to make sure that this value does not default to a percent complete based on remaining duration. According to the SDEF, this field represents the EARNED VALUE of the work in place for each activity. Users MUST run a test to ensure that the current version of the SDEF routine correctly loads the cost data during import. Test results indicated that the SDEF data was not correctly imported. To obtain a zero value in the SDEF file, users must enter the value "0.01" in the data field. It is recommended that revised SDEF documentation explain that the one cent value must be entered to obtain a zero output. In the distribution version of the SDEF routines it is recommended that a default be provided.
STORED MATERIALS	63 - 74	12	✓	Format 9.2	Right Justified	Supplemental user documentation describes how to add this AlderGraf resource code category. These instructions must be followed exactly to ensure that data is exported correctly. The value for STORED MATERIAL may be directly added to the Edit Activity Screen with the add field command, F4. Use of the resource updating routines for this data is not required. Note that there is no provision to ensure that the STORED MATERIAL costs are a subset of the COST TO DATE. It is recommended that revised SDEF documentation address the specific steps needed, and what is not needed, to obtain a correct value for this field. To obtain a zero value in the SDEF file, users must enter the value "0.01" in the data field. It is recommended that revised SDEF documentation explain that the one cent value must be entered to obtain a zero output. In the distribution version of the SDEF routines it is recommended that a default be provided.
EARLY START DATE	76 - 82	7	✓	ddmmmyy	Filled if Not Started	None.
EARLY FINISH DATE	84 - 90	7	✓	ddmmmyy	Filled if Not Finished	None.
LATE START DATE	92 - 98	7	✓	ddmmmyy	Filled if Not Started	None.
LATE FINISH DATE	100 - 106	7	✓	ddmmmyy	Filled if Not Finished	None.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
FLOAT SIGN	108 - 108	1	+, -	Fixed	Filled if Not Finished	None.
TOTAL FLOAT	110 - 112	3	✓	Integer	Right Just. if Not Finished	None.

Table D9. AlderGraf Project End Record data format.

SDEF Field	Column	Max.	Value	Notes	Comments
	Position	Len.			
RECORD IDENTIFIER	1 - 3	3	END	Fixed	None

Exporting an SDEF File

The export routines are built directly into the AlderGraf menu structure and are very easy to find and use.

Although the export process erases the target diskette prior to export, a list of files on the disk is shown and the user is given the opportunity to put in another disk prior to proceeding. This is a very good feature of the export routine.

The extension ".txt" on text files is common to the point of becoming almost standard for ASCII files. In addition, the "edit" and "notepad" systems assume ".txt" extensions. **It is recommended that the production version of the SDEF routines provide the default extension of ".txt" for all export files.**

Features that go beyond those of the SDEF are not checked during the export process. The result is that SDEF files may be created that do not include all necessary information for consistent scheduling calculations. An example is the use of Start-to-Finish sequence. **It is recommended that the production version of the SDEF routines report errors on all items that may cause deviation between the capabilities of the AlderGraf system and the capacity of the SDEF to accept those capabilities.**

Importing an SDEF File

The most significant finding during the import process was that actual cost data was not imported correctly. Because importing actual cost data is critical to the effective use of the SDEF, additional import checks were not performed. **THE SYSTEM MUST BE REVISED PRIOR TO ANY FURTHER IMPORT TESTING OR POSSIBLE FUTURE RECOMMENDATION FOR USE OF THE SYSTEM FOR IMPORTING SDEF FILES.**

Conclusions

Once a template project is created and used for SDEF projects, the AlderGraf system quickly produces a correctly formatted SDEF file. User requirements for entering what could be considered "trivial" cost data should be eliminated in the next release of the system. Programs for importing SDEF files must be revised prior to recommendation of this system for importing SDEF files.

Acknowledgments

Appreciation is expressed to Mr. Alderfer, President AlderGraf Systems, Inc. for numerous discussions with Corps Representatives over the course of the testing to resolve various issues and discuss upcoming product releases. In addition to the software provided to USACERL for testing, Mr. Alderfer also provided a demonstration version of the software to the Corps of Engineers Omaha District for evaluation.

Test Project Description

The project used to test the system was the "Warehouse Project" used as an example throughout the Associated General Contractors of America's publication *Construction Planning and Scheduling* (Associated General Contractors of America, **date). Pages 47 and 243 of this publication contain some of the figures for this project. The sequence between the activities was developed using start-to-start and finish-to-finish logic from the bar chart on page 243. Progress values were obtained for the project from page 242.

Appendix E: Open Plan, Version 5.1

Distribution version 5.1, when supplemented with a disk that included additional program, project, and template files, met the SDEF specifications and is recommended for use by Contractors and Corps of Engineers offices for SDEF export and import. Before using the AlderGraf system to import or export SDEF files, users should review the additional information found in this report.

The SDEF points of contact at Welcom Software Technology are Chris Jensen and Randy Armstrong, WST Corporation, 15995 North Barkers Landing, Suite 275, Houston, TX 77079; telephone (713) 558-0514, FAX (713) 584-7828.

Installing the Software

- Did the program tested appear to be a distribution version of the software ? **Yes**
- Did the program require additional files not contained on the system disks ? **Yes**

A data disk received on 12 January 1995 was required in addition to existing program files.

When installing the sample projects, an error occurred after responding "Yes" to the question regarding overwriting the project directory. The error message was a "Syntax Error." The offending line of code that was displayed was "&q". After selecting the "ignore" option, the remainder of the program files loaded correctly. Also, after working with the system for some time the tester deleted the projects and templates and re-installed them without a problem. This was unexpected, because the initial installation had resulted in errors.

It is recommended that the installation problem be corrected prior to including the SDEF routines as part of Open Plan distribution disks. It is not known if selecting the "ignore" option has caused additional problems with the imported programs. This item will not keep the system from being recommended for SDEF export/import.

Creating an SDEF-Compatible Project

The software was installed and instructions in the supplemental documentation were followed to modify the data structure and add the supplemental program, templates, projects, and reports. The sample project PDMC was copied to a new project and a test project was entered manually. An update of the sample project was also created with simulated progress. Copies of these sample projects were saved using the software system's backup utility for future reference. A copy of the backup files will be provided to software vendors upon request. Files will be made available to all others via anonymous ftp service through cecer.army.mil.

- Was SDEF documentation provided with the system? **Yes**

SDEF documentation was provided in a separate three-ring binder. The instructions provided were excellent and covered all aspects of installing the supplemental programs, templates and projects. Of all the vendors' supplemental documentation received, the Open Plan documentation was the best. It is recommended that the SDEF documentation be included in a future distribution version of the documentation.

- Was SDEF documentation sufficient for easy creation of SDEF projects? **Yes**

The following tables show how data should be formatted for each record. Comments guide the user in matching the product's data to the SDEF, and indicate any difficulties encountered or recommendations.

In the **Req. Value** column, a check mark means that the data is required. For a dash (-) in the **Req. Value** column or "See spec" in the **Notes** column, check the explanation for that item in the draft SDEF specification (Appendix A).

Table E1. Open Plan Volume Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	VOLM	Fixed	Filled	Is VOLM record on line one (1) of the SDEF file produced for this system? No
DISK NUMBER	6 - 7	2	✓	Number	Right Justified	None

Table E2. Open Plan Project Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	PROJ	Fixed	Filled	None.
DATA DATE	6 - 12	7	✓	ddmmmyy	Filled	Corresponds to OpenPlan "Tnow" field.
PROJECT IDENTIFIER	14 - 17	4	✓	Alpha.	Left Justified	Instructions are provided to users indicating the SDEF maximum of four characters for this field.
PROJECT NAME	19 - 66	48	✓	Alpha.	Left Justified	Instructions for modifying the existing project name field were provided in the supplemental SDEF documentation.
CONTRACTOR NAME	68 - 103	36	✓	Alpha.	Left Justified	Instructions for modifying the database structure to add this field were provided in the supplemental SDEF documentation.
ARROW OR PRECEDENCE	105 - 105	1	A, P	Fixed	Filled	OpenPlan supports both arrow and precedence diagrams.
CONTRACT NUMBER	107 - 112	6	✓	Alpha.	Left Justified	Instructions for modifying the database structure to add this field were provided in the supplemental SDEF documentation.
PROJECT START	114 - 120	7	✓	ddmmmyy	Filled	Corresponds to OpenPlan "Projstart" field. The system appears to put a value for the start date that is incorrect. The date format exported was 07/31/95 not 01JUL95 as required by the SDEF format. This error did not occur during normal operations but only when the start date was forced to be the same date as the data date. If this problem occurs, users may modify the file using the edit command. Because this error appears to be an intermittent problem and several previous SDEF export files have passed the test without an error on this field, this item will not keep the system from being recommended for use for SDEF import/export. It is recommended, however, that the code for this routine be checked to ensure that all possible errors have been trapped. Instructions on this item to keep the error from occurring should be included in revised SDEF documentation, if necessary.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
PROJECT END	122 - 128	7	✓	ddmmmyy	Filled	Corresponds to OpenPlan "LEFDATE" field. A "finish on" milestone was placed in the project data and the schedule. The schedule that was exported did not have a late finish milestone for the last activity in the schedule. The effect of the finish on project milestone was to fix the last activity in the schedule. Unfortunately the last activity in the schedule did not have a corresponding late finish milestone. Because some systems do not use a project end date as a defacto late finish milestone for the last activity on the project, it is recommended that Open Plan users not use this feature of the program but instead place a late finish milestone on the last activity in the schedule. It is recommended that revised system documentation provide these instructions to the user.

Table E3. Open Plan Calendar Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	CLDR	Fixed	Filled	None.
CALENDAR CODE	6 - 6	1	✓	Alpha.	Filled	While the SDEF allows alphanumeric calendar codes, certain scheduling systems do not allow letters for calendar codes. To accommodate these other vendors, calendar code values should be limited to numeric values. It is recommended that revised SDEF documentation note that values for calendar codes should only be values from 1 to 9.
WORKDAYS	8 - 14	7	SMTWTFS	Fixed	Filled	None.
CALENDAR DESCRIPT	16 - 45	30	✓	Alpha.	Left Justified	None

Table E4. Open Plan Holiday Record data.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes
RECORD IDENTIFIER	1 - 4	4	HOLI	Fixed	Filled
CALENDAR CODE	6 - 6	1	✓	Alpha.	Filled
HOLIDAY DATE	8 - 14	7	✓	ddmmmyy	Filled
HOLIDAY DATE	16 - 22	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	24 - 30	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	32 - 38	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	40 - 46	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	48 - 54	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	56 - 62	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	64 - 70	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	72 - 78	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	80 - 86	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	88 - 94	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	96 - 102	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	104 - 110	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	112 - 118	7	-	ddmmmyy	May be Filled
HOLIDAY DATE	120 - 126	7	-	ddmmmyy	May be Filled

General Comments: Calendars that are not used by any activities are included in the export file. It is recommended that only the calendars in use be exported. Changing the export routines to only export the calendars used will not keep the program from being recommended for SDEF import/export use.

Table E5. Open Plan Activity Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	ACTV	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	Corresponds to the "Activity ID" field of the custom Activity Details Window in the Project Update Screen. The ACTIVITY ID in OpenPlan may be alphanumeric. OpenPlan alphanumeric activity identifiers are not supported by the SDEF. If every member of the project is using software that supports it, alphanumeric data for the ACTIVITY ID field may be approved. But if any team member's program does not support alphanumeric values, then the ACTIVITY ID shall strictly comply with the SDEF. It is recommended that this item be included in revised SDEF documentation. Users should be encouraged to obtain written approval for alphanumeric ACTIVITY IDs prior to creating a project schedule.
ACTIVITY DESCR.	17 - 46	30	✓	Alpha.	Left Justified	None.
ACTIVITY DURATION	48 - 50	3	✓	Integer	Right Justified	None.
CONSTRAINT DATE	52 - 58	7	-	ddmmmyy	May be Filled	None.
CONSTRAINT TYPE	60 - 61	2	-	ES or LF	May be Filled	Corresponds to the "Date Constraints" field of the custom Activity Details Window in the Project Update Screen. As discussed in the OpenPlan user documentation, the SDEF only allows the use of the "NE" and "NL" constraints. The custom screen form prompts users to include only allowable values.
CALENDAR CODE	63 - 63	1	✓	Alpha.	Filled	Corresponds to the "Calendar" field of the custom Activity Details Window in the Project Update Screen. See comment regarding acceptable values for this field under the Calendar Record (Table E3)..
HAMMOCK CODE	65 - 65	1	Y, blank	Fixed	May be Filled	Hammock activities appeared to export correctly.
WORKERS PER DAY	67 - 69	3	-	Integer	Right Justified	Provided in custom screen form.
RESPONSIBILITY CODE	71 - 74	4	-	Alpha.	Left Justified	Provided in custom screen form.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
WORK AREA CODE	76 - 79	4	-	Alpha.	Left Justified	Provided in custom screen form.
MOD OR CLAIM NO.	81 - 86	6	-	Alpha.	Left Justified	Provided in custom screen form.
BID ITEM	88 - 93	6	-	Alpha.	Left Justified	Provided in custom screen form.
PHASE OF WORK	95 - 96	2	-	Alpha.	Left Justified	Provided in custom screen form.
CATEGORY OF WORK	98 - 98	1	-	Alpha.	May be Filled	Provided in custom screen form.
FEATURE OF WORK	100 - 129	30	-	Alpha.	Left Justified	Provided in custom screen form.

General Comments: To use the data required by the SDEF, Open Plan users should create new projects by copying the template projects PCOE, precedence project, and ACOE, arrow project. These template projects, provided on a supplemental data disk, contain the correct dbase structures to support the SDEF as well as custom screen forms.

Table E6. Open Plan Precedence Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	PRED	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	See note in previous table regarding the use of alphanumeric values.
PRECEDING ACTIVITY	17 - 26	10	✓	Integer	See Spec	See note in previous table regarding the use of alphanumeric values.
PREDECESSOR TYPE	28 - 28	1	✓	S, F, C	Filled	Users should refer to supplemental SDEF documentation for further information on this field.
LAG DURATION	30 - 33	4	✓	Integer	Right Justified	OpenPlan allows negative values for LAG DURATION, which is not supported by the SDEF. It is recommended that revised SDEF documentation indicate that users cannot use negative lags for SDEF projects. In the distribution version of the SDEF routines, it is recommended that an error message be reported if negative lags are found.

Table E7. Open Plan Unit Cost Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	UNIT	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	None.
TOTAL QTY	17 - 29	13	✓	Format 8.4	Right Justified	This field corresponds to the new OpenPlan field "Mos-Total". User-defined browse routines may be created to modify this data.
COST PER UNIT	31 - 43	13	✓	Format 8.4	Right Justified	This field corresponds to the new OpenPlan field "Mos-Cost". User-defined browse routines may be created to modify this data.
QTY TO DATE	45 - 57	13	✓	Format 8.4	Right Justified	This field corresponds to the new OpenPlan field "Mos-Todate". User-defined browse routines may be created to modify this data.
UNIT OF MEASURE	59 - 61	3	✓	Alpha.	Left Justified	This field corresponds to the new OpenPlan field "Mos-Unit". User-defined browse routines may be created to allow users to modify this data.

Other Comments: The unit cost items are not provided on a custom user screen as part of the default project. In addition, programming to make the values for the unit data consistent with budgeted and cost to date fields does not appear to be included with the program. If there is unit cost data, the activity cost in the progress record should be equal to the product of the total quantity and the cost per unit. The cost to date in the progress record should be equal to the cost per unit times the quantity to date. Not having default calculation methods in place will require users to check the unit cost data by hand to ensure that the proper values are produced. **It is recommended that revised SDEF screens include the unit cost data, calculations for activity cost and cost to date. In addition, revised SDEF documentation should discuss how to correctly develop unit cost data.**

Table E8. Open Plan Progress Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	PROG	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	None.
ACTUAL START DATE	17 - 23	7	✓	ddmmmyy	Filled if Started	If there is no actual cost data provided and the cost to date is not equal to zero, then an error message will be displayed. This error will not, however, force the user to enter an actual start date. It is recommended that future versions of the SDEF screen form require users to enter an actual date. A default of the data date may be provided for the user, however, some date must be provided. It is recommended that revised SDEF documentation be provided to explain the SDEF requirement for actual starts. This item will not keep the system from being recommended for SDEF export/import.
ACTUAL FINISH DATE	25 - 31	7	✓	ddmmmyy	Filled if Finished	There is no check to ensure that an actual finish date is provided if the remaining duration is zero. The output resulting from an activity with a remaining duration of zero and an actual cost equal to the budgeted cost was incorrect. There was no ACTUAL FINISH DATE and the EARLY FINISH DATE and LATE FINISH DATE fields were also blank. It is recommended that future versions of the SDEF screen forms require a finish date when time and cost are both completed. Revised SDEF documentation should indicate that an actual finish date should always be required in these circumstances. This item will not keep the system from being recommended for SDEF export/import.
REMAINING DURATION	33 - 35	3	✓	Integer	Right Justified	OpenPlan supports both remaining duration and percent complete. According to user documentation, percent complete may be used to generate both the remaining duration and the percent complete. User documentation indicates that the way to update progress that is consistent with the SDEF is to use the remaining duration.
ACTIVITY COST	37 - 48	12	✓	Format 9.2	Right Justified	None.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
COST TO DATE	50 - 61	12	✓	Format 9.2	Right Justified	If the COST TO DATE amount exceeds the ACTIVITY COST field, a warning message is given. See also the comments under ACTUAL FINISH DATE above. There is a problem with importing the COST TO DATE field from an SDEF file. The import does not bring the data into the correct field. Also, the decimal places were truncated.
STORED MATERIALS	63 - 74	12	✓	Format 9.2	Right Justified	The SDEF format indicates that the STORED MATERIAL field is to be that portion of the COST TO DATE amount that is stored materials. The STORED MATERIALS and the COST TO DATE should not exceed ACTIVITY COST. It is recommended that an error check be made to determine if the COST TO DATE and the STORED MATERIAL cost exceed the budgeted cost. Revised user documentation should explain that the stored materials are a subset of the overall cost to date. This item will not keep the system from being recommended for SDEF export/import.
EARLY START DATE	76 - 82	7	✓	ddmmmyy	Filled if Not Started	None.
EARLY FINISH DATE	84 - 90	7	✓	ddmmmyy	Filled if Not Finished	None.
LATE START DATE	92 - 98	7	✓	ddmmmyy	Filled if Not Started	None.
LATE FINISH DATE	100 - 106	7	✓	ddmmmyy	Filled if Not Finished	None.
FLOAT SIGN	108 - 108	1	+,-	Fixed	Filled if Not Finished	None.
TOTAL FLOAT	110 - 112	3	✓	Integer	Right Just. if Not Finished	None.

Table E9. Open Plan Project End Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 3	3	END	Fixed	Filled	None

Exporting an SDEF File

The export/import routines are included as menu items under the Utilities menu. It is recommended that references to the Corps of Engineers be removed from the menu selection. All references to the format should only be called the "Standard Data Exchange Format," which should increase awareness and use of the format.

The export routine appears to work according to the SDEF specification, provided the items noted in **Creating an SDEF-Compatible Project** above are considered when creating a project and editing activities.

Importing an SDEF File

As noted in supplemental SDEF documentation, users should begin the import process by copying a template project, either ACOE or PCOE, over to a new project name. ACOE or PCOE should be used because they do not contain any activities. If the user selects a project that contains activities, then he or she will need to delete all activities in the project. Importing data into an existing project will overwrite those activities with matching Activity IDs. Activities that are in the file prior to the import that are not overwritten will remain in the project. **It is recommended that a clarification of this point be included in revised SDEF documentation.**

The import routine does not automatically recalculate the schedule. It is recommended that users recalculate the schedule after importing the data.

Conclusions

Use of Open Plan template projects allows users to quickly develop and export projects that meet the SDEF.

Differences between scheduling systems within Open Plan depend largely on the version of the database engine that is behind Open Plan. Dbase IV was used during testing, with mixed results. Before using the import routines for "real" data, users may want to use the routines on a small test file to ensure that data is correctly imported into the system.

Acknowledgments

Appreciation is expressed to Chris Jensen and Randy Armstrong, WST Corporation, for numerous discussions with Corps representatives over the course of the testing to resolve various issues.

Test Project Description

The project used to test the SDEF routines in Open Plan was a four-unit housing construction project. The table below shows the activity list that was used as the basis for the project. Activity Codes and costs were added to this schedule for use in SDEF testing.

Table E10. Open Plan test project activity list.

No.	Activity Name	Days	Priors
1	Deliver Materials	5	-
2	Excavate	2	1
3	Drainage	2	2
4	Landscape	4	3
5	Make Roof	4	1
6	Make Walls	6	1
7	Foundation	5	2
8	Structure	5	5, 6, 7
9	Doors & Windows	3	8
10	Electrical	3	8
11	Mechanical	4	8
12	Plumbing	2	8
13	Fence	3	4
14	Appliances	2	9, 10, 11, 12
15	Interior Finish	3	9, 10, 11, 12
16	Hot Tub	2	9, 10, 11, 12, 13
17	Clean-Up	2	14, 15, 16

Appendix F: PMS-80, Version 6.40

The custom version of the system tested (including additional files and instructions), met the SDEF specifications, and is recommended for use by Contractors and Corps of Engineers offices. At the time of this report, all needed programming changes have been made and included in a supplemental program disk. Until the production version of the system containing the SDEF programs is complete, PMS-80 customers may obtain copies of the SDEF routines directly from Pinnel-Busch Engineers. The SDEF programs are to be incorporated into version 6.40 to be released in April 1995. Additional information found in this report may be used as a supplement to system documentation and should be reviewed prior to using the system for SDEF import/export.

The SDEF point of contact for PMS-80 is Perry Smith, Pinnell-Busch, Inc., 6420 S.W. Macadam Avenue, Suite 330, Portland, OR 97201; tel: (503) 293-6280.

Installing the Software

- Did the program tested appear to be a distribution version of the software? **No**

Test files received January 9, 1995 for version 6.40 were updated to solve several items discussed below. Additional program files were received February 9, 1995.

- Did the program require additional files not contained on the system disks? **Yes**

Creating an SDEF-Compatible Project

Once the software was installed, the sample project was entered manually into the software system. A copy of the backup files will be provided to

software vendors upon request. Files will be made available to all others via anonymous ftp service through cecer.army.mil.

- Was SDEF documentation provided with the system? **Yes**

Additional pages were provided that describe, with figures, the procedure to be followed when using the SDEF. Instructions were provided for creating projects and activities compatible with the SDEF format. The instructions also contain the information needed to ensure that PMS-80 users will be able to create SDEF schedules without any problems.

- Was SDEF documentation sufficient for easy creation of SDEF projects?
Yes

Users familiar with the PMS-80 system should have no problem following the instructions provided. Users familiar with the Split/Merge facility to create project schedules should note that all activity codes except the Feature of Work code are copied to new activities during the merging process. It is recommended that the "Feature of Work" code be included as part of the Split/Merge process. This item will not keep the system from being recommended for SDEF import/export.

The following tables show how data should be formatted for each record. Comments guide the user in matching the product's data to the SDEF, and indicate any difficulties encountered or recommendations. In the **Req. Value** column, a check mark means that the data is required. For a dash (-) in the **Req. Value** column or "See spec" in the **Notes** column, check the explanation for that item in the draft SDEF specification (Appendix A).

Table F1. PMS-80 Volume Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	VOLM	Fixed	Filled	• Is VOLM record on line one of the SDEF file produced for this system? Yes
DISK NUMBER	6 - 7	2	✓	Number	Right Justified	None

Table F2. PMS-80 Project Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	PROJ	Fixed	Filled	None.
DATA DATE	6 - 12	7	✓	ddmmmyy	Filled	Data exported correctly.
PROJECT IDENTIFIER	14 - 17	4	✓	Alpha.	Left Justified	PMS-80 projects are identified with a six-character name and an update number. This format is not used in the SDEF, as described in the supplemental manual section 8.7.2.2. It is recommended that the documentation add a sentence or two describing the need for a good project output file name so that prior files are not overwritten. For example, the file name could have the update number as the extension. The supplemental manual section 8.7.2.6 should add that "I" will create a new project and "E" will import the data to the current project. It is recommended that this information be explained in a future revision to SDEF section of the User's Manual.
PROJECT NAME	19 - 66	48	✓	Alpha.	Left Justified	Field #2 of the PROSDEF screen.
CONTRACTOR NAME	68 - 103	36	✓	Alpha.	Left Justified	Field #3 of the PROSDEF screen.
ARROW OR PRECEDENCE	105 - 105	1	A, P	Fixed	Filled	Arrow and precedence diagrams are both supported by PMS-80. It appears, however, that the PROSDEF and ACTSDEF specialized screen forms assume that the schedule is going to be in the precedence diagram format. Potential users of SDEF files who are interested in using arrow diagrams should contact PMS-80. Mr. Smith has agreed to develop SDEF arrow diagram screen forms upon request by registered PMS-80 users. It is recommended that this information be included in a future revision to SDEF section of the User's Manual.
CONTRACT NUMBER	107 - 112	6	✓	Alpha.	Left Justified	Field #201 of the PROSDEF screen.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
PROJECT START	114 - 120	7	✓	ddmmmyy	Filled	Fields #37 and #38 of the PROSDEF screen. Users familiar with PMS-80 will be able to use these data fields correctly. Because entering values in these fields may result in different schedule calculations as SDEF data is transferred from system to system, it is recommended that the data remain blank. To start the project on a specific day the first activity in the schedule should be constrained with an early start type constraint. It is recommended that additional information on this topic be provided in a future revision to SDEF section of the User's Manual. According to PMS-80 representative Mr. Smith, PMS-80 will create a starting project activity based on a Project Start date, if indicated by users.
PROJECT END	122 - 128	7	✓	ddmmmyy	Filled	Fields #41 and #42 of the PROSDEF screen. This data is for reference only and does not appear to affect schedule calculations. If this information does, however, affect schedule calculations, then the data should be left blank. A late finish constraint should be used on the last activity of the network to force negative float for activities that are behind schedule. It is recommended that revised SDEF documentation discuss this topic in more detail.

Table F3. PMS-80 Calendar Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	CLDR	Fixed	Filled	None.
CALENDAR CODE	6 - 6	1	✓	Alpha.	Filled	PMS-80 allows the use of three calendars: a 5-day work week calendar, a 7-day work week calendar, and a working week schedule. The 5-day schedule is the default value for each activity; a blank in the field results in the use of the five-day schedule. The designation "W" is used to change the units of time from days to weeks in field #16 of the Activity Input Screen. The work week calendar and holidays are exported into the SDEF file as calendar "1". The 7-day work week calendar is identified by placing the value "C" for calendar day schedule in field #16 of the Activity Input Screen. The 7-day work week schedule is exported to the SDEF file as calendar "2". During import, the first calendar that is not a 7-day calendar is imported as calendar "1". Other non-7-day work week calendars result in import error messages. It is recommended that prior to working with SDEF files, users determine the capabilities of the systems to be used in the SDEF exchange. Any calendars that are used on the project should be developed in such a way as to ensure that all systems will be able to support the system with the minimum set of calendar data.
WORKDAYS	8 - 14	7	SMTWTFS	Fixed	Filled	None.
CALENDAR DESCRIPTION	16 - 45	30	✓	Alpha.	Left Justified	None.

Table F4. PMS-80 Holiday Record data format.

Description	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	HOLI	Fixed	Filled	None.
CALENDAR CODE	6 - 6	1	✓	Alpha.	Filled	See comment regarding CALENDAR CODE in the preceding table.
HOLIDAY DATE	8 - 14	7	✓	ddmmmyy	Filled	No comments for any HOLIDAY DATE.
HOLIDAY DATE	16 - 22	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	24 - 30	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	32 - 38	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	40 - 46	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	48 - 54	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	56 - 62	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	64 - 70	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	72 - 78	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	80 - 86	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	88 - 94	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	96 - 102	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	104 - 110	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	112 - 118	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	120 - 126	7	-	ddmmmyy	May be Filled	

Table F5. PMS-80 Activity Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	ACTV	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	Use of alphanumeric activity IDs or numbers up to six characters in length must be accomplished per instructions on Section 6, pages 6-33 of the user's manual. It is recommended that the SDEFACT screen form allow the maximum characters (ten) specified in the SDEF format. This information should be included in a revised SDEF documentation.
ACTIVITY DESCR.	17 - 46	30	✓	Alpha.	Left Justified	The PMS-80 custom screen form ACTSDEF allows users to export correctly sized activity descriptions.
ACTIVITY DURATION	48 - 50	3	✓	Integer	Right Justified	None.
CONSTRAINT DATE	52 - 58	7	-	ddmmmyy	May be Filled	None.
CONSTRAINT TYPE	60 - 61	2	-	ES or LF	May be Filled	PMS-80 allows more than the two types of constraints specified. Because constraints other than the two supported by the SDEF may result in different scheduling calculations, these other constraint types should not be used. Supplemental user documentation includes this information. This information is provided in the supplemental SDEF instructions and should be included in revised SDEF documentation.
CALENDAR CODE	63 - 63	1	✓	Alpha.	Filled	PMS-80 allows for three calendar types: one variable calendar (indicated by blank), one calendar with units of weeks (denoted by "W"), and one seven-day week calendar (indicated by a "C" for calendar day calendar. Use of the "W" calendar has not been fully tested at the time of this test report. SDEF users who wish to select activities with duration in weeks should conduct a test of this feature prior to exchanging data disks. This information should be provided in a future revision to SDEF section of the User's Manual.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
HAMMOCK CODE	65 - 65	1	Y, blank	Fixed	May be Filled	Field #32 and following on the ACTSDEF screen. For precedence diagrams, PMS-80 allows hammers via the use of a code in the "lag/lead" field of the activity descriptions. Hammer activities appear to export correctly to the SDEF format. See comments under the PREDECESSOR TYPE field in the following table (Precedence Record). This should be included in a future revision to SDEF section of the User's Manual.
WORKERS PER DAY	67 - 69	3	-	Integer	Right Justified	The user must include two default data items for every activity. These are: Field #51 "Workers/Day (Enter LAB)" where the user must always fill this field with "LAB", according to the instructions on the screen; Field #59 "Enter D" where the user must always fill this field with "D"; and Field #60 "Number of Workers/Day", where the user must always fill in a value, including zero (0). All values must be filled to successfully create the SDEF file. The February 1995 program update includes default values for these fields. Users should check the revised SDEF user's manual for the operation of these default values.
RESPONSIBILITY CODE	71 - 74	4	-	Alpha.	Left Justified	This code is found in Field #3, "Department Respon", as a three-character code. The four characters required by the SDEF specification data are truncated on import. This information is contained in the supplemental SDEF instructions and should be included in a future revision to the user's manual. Users should ensure that those creating SDEF files for import into PMS-80 only have a three-character Responsibility Code.
WORK AREA CODE	76 - 79	4	-	Alpha.	Left Justified	Field #39 of the ACTSDEF screen.
MOD OR CLAIM NO.	81 - 86	6	-	Alpha.	Left Justified	Field #200 of the ACTSDEF screen.
BID ITEM	88 - 93	6	-	Alpha.	Left Justified	Field #201 of the ACTSDEF screen.
PHASE OF WORK	95 - 96	2	-	Alpha.	Left Justified	Field #202 of the ACTSDEF screen.
CATEGORY OF WORK	98 - 98	1	-	Alpha.	May be Filled	Field #203 of the ACTSDEF screen.
FEATURE OF WORK	100 - 128	30	-	Alpha.	Left Justified	Field #204 of the ACTSDEF screen.

Table F6. PMS-80 Precedence Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	PRED	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	Use of alphanumeric activity IDs or numbers up to six characters in length must be accomplished per instructions on Section 6, page 6-33 of the User's Manual. It is recommended that the SDEFACT screen form allow the maximum (ten) characters specified in the SDEF format. This information should be included in a future revision to the User's Manual.
PRECEDING ACTIVITY	17 - 26	10	✓	Integer	See Spec	Use of alphanumeric activity IDs or numbers up to six characters in length must be accomplished per instructions on Section 6, page 6-33 of the User's Manual. It is recommended that the SDEFACT screen form allow the maximum (ten) characters specified in the SDEF format. This information should be included in a future revision to the User's Manual.
PREDECESSOR TYPE	28 - 28	1	✓	S, F, C	Filled	Only the Start-to-Start, activity type "S"; Finish-to-Finish, activity type "F"; and Hammock activity, type "H", are supported by PMS-80. Note that other PMS-80 activity types (fields #32-37, Section 3.10 of the user's manual) do not conform to the SDEF. This information should be included in a future revision to the User's Manual.
LAG DURATION	30 - 33	4	✓	Integer	Right Justified	PMS-80 allows negative lag values as part of the ACTSDEF screen. Negative lags are not allowed by the SDEF. This information should be included in a future revision to the User's Manual.

Table F8. PMS-80 Progress Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	PROG	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	Use of alphanumeric activity IDs or numbers up to six characters in length must be accomplished per instructions on Section 6, page 6-33 of the User's Manual. It is recommended that the SDEF screen form allow the maximum (ten) characters specified in the SDEF format. This information should be included in a future revision to the User's Manual.
ACTUAL START DATE	17 - 23	7	✓	ddmmmyy	Filled if Started	Field #8 and #9 of the ACTSDEF screen.
ACTUAL FINISH DATE	25 - 31	7	✓	ddmmmyy	Filled if Finished	Fields #12 and #13 of the ACTSDEF screen.
REMAINING DURATION	33 - 35	3	✓	Integer	Right Justified	Field #5 of the ACTSDEF screen. PMS-80 uses a set of default values to assign progress to activities. While allowing easier progress updating, users should, to ensure that the correct values for all activities are included provide both a "Remaining Duration" and an "Activity Cost to Date" value. This defaulting mechanism should be familiar to users of PMS-80.
ACTIVITY COST	37 - 48	12	✓	Format 9.2	Right Justified	Field #47 of the ACTSDEF screen. The February 1995 update to the SDEF import/export program allowed zeros to be exported as the default when this field is blank.
COST TO DATE	50 - 61	12	✓	Format 9.2	Right Justified	Field #45 of the ACTSDEF screen. PMS-80 uses a set of default values to assign progress to activities. While allowing easier progress updating, users should, to ensure that the correct values for all activities are included, provide both a "Remaining Duration" and an "Activity Cost to Date" value. This defaulting mechanism should be familiar to users of PMS-80. The February 1995 update to the SDEF import/export program allowed zeros to be exported as the default when this field is blank.

Table F9. PMS-80 Project End Record data format.

SDEF Field	Column Position	Max. Len.	Reqd. Value	Notes	Comments
RECORD IDENTIFIER	1 - 3	3	END	Fixed	None.

Exporting an SDEF File

The PMS-80 export routine is designed and executed well and consistently with other PMS-80 screens. Users familiar with PMS-80 will have no trouble exporting data files. **It is recommended that previous version of PMS-80 be removed from the menu, because there is only one version of the format.**

To assist users, a DOS "disk not found" and other similar hardware-related error messages should be trapped, allowing users not to have to deal with the "Abort, Retry, Fail?" prompt.

Importing an SDEF File

Problems found during import and creation of a new file have been corrected in the February 1995 program update.

After import, users must recalculate the schedule.

Conclusions

PMS-80 provides an integrated approach to developing, importing, and exporting SDEF files. The areas to coordinate with others when using PMS-80 are the use of multiple calendars, length of the ACTIVITY IDs, and the RESPONSIBILITY CODE data. Coordination is needed in these areas because PMS-80 limits the values more closely than does the SDEF.

Acknowledgments

Appreciation is expressed to Perry Smith for his work to coordinate and develop the SDEF routines. Appreciation is also expressed to Steve Pinnell of Pinnell-Busch Engineers for his support of the SDEF effort.

Test Project Description

The following project was used as the basis for the project schedule used to test PMS-80. Activities 3-11 were copied using the "Split/Merge" feature of PMS-80 to develop a complete schedule. Following the initial test of export data, specific activities were modified on an ad-hoc basis to test multiple calendars, variations in cost, hammock activities, and other items.

Table F10. PMS-80 test project data.

No.	Description	Dur	Prior	Resp	Wkr/ day	Area	Bid	Ph.	Cat	Feature	\$
1	Notice to Proceed	1	none								0
2	Procure Matl and Equip	90	1								0
3	Survey Road	2	2	SUR	3	ONE	1	1	1	Surveying	2,000
4	Clear and Grub	2	3	LBR	10	ONE	1	1	1	To Grade	10,000
5	Cut and Fill	4	4	DOZ	5	ONE	1	1	1	To Grade	5,000
6	Rough Grade	6	5,10	DOZ	5	ONE	1	1	1	To Grade	20,000
7	Place Gravel	2	6	TRK	3	ONE	1	1	2	Final Grade	15,000
8	Compact Roadbed	4	7	ROL	5	ONE	1	1	2	Final Grade	10,000
9	Excavate for Culvert	3	4	HOE	5	ONE	2	1	3	Culverts	20,000
10	Place Culvert	1	9	HOE	5	ONE	2	1	3	Culverts	3,000
11	Prepare Inlet and Outlet	5	10	DOZ	3	ONE	2	1	3	Culverts	15,000

Appendix G: PPMS-30,000, Version 4.02

A production version of the system was tested. This custom version met the SDEF specifications and is recommended for use by contractors and Corps of Engineers offices for the creation and exchange of SDEF-compatible arrow diagram files. Additional information found in this report must be reviewed prior to successfully using the system for import/export of SDEF files.

The SDEF point of contact was Justin Smith, Advanced Project Approach, Inc., P.O. Box 802070, Dallas, TX 75380; telephone (214) 929-1877, FAX (214) 929-1490.

Installing the Software

- Did the program tested appear to be a distribution version of the software? **Yes**
- Did the program require additional files not contained on the system disks? **No**

Creating an SDEF-Compatible Project

Once the PPMS-30,000 software was installed, the sample project was entered manually into the software system. A copy of the backup files will be provided to software vendors upon request. Files will be made available to all others via anonymous ftp service through cecer.army.mil.

- Was SDEF documentation provided with the system? **Yes**

Section 15 of the User's Manual contains a brief description of file transfer operations, including the SDEF files; however, the necessary level of detail for these instructions has not been provided. **It is recommended that supplemental user documentation be developed to assist users in creating SDEF-compatible files.**

Appendix 20 lists the SDEF but does not contain the most recent version of it. **It is recommended that the correct specification be used.**

The SDEF Point of Contact, listed above, provided additional information during telephone calls. The information obtained is provided in the appropriate sections of this test report. **It is recommended that revised SDEF documentation contain the complete set of information needed to correctly use the SDEF.**

- Was SDEF documentation sufficient for easy creation of SDEF projects? **No**

Detailed test results provide the additional information required during this test to create a correct SDEF file. It is recommended that the additional information required during the test be included, in some fashion, in revised SDEF documentation.

The following tables show how data should be formatted for each record. Comments guide the user in matching the product's data to the SDEF, and indicate any difficulties encountered or recommendations. In the **Req. Value** column, a check mark means that the data is required. For a dash (-) in the **Req. Value** column or "See spec" in the **Notes** column, check the explanation for that item in the draft SDEF specification (Appendix A).

Table G1. PPMS Volume Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	VOLM	Fixed	Filled	Is VOLM record on line one (1) of the SDEF file produced for this system? Yes
DISK NUMBER	6 - 7	2	✓	Integer	Right Justified	None.

Table G2. PPMS Project Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	PROJ	Fixed	Filled	None.
DATA DATE	6 - 12	7	✓	ddmmmyy	Filled	Calculation of a schedule in PPMS requires that a two-step process be followed for all projects. The first step is to run the schedule calculation and indicate that the file is not an update. The second step is to run the schedule as update and provide the data date. While frequent users of PPMS should be familiar with this process, casual users of the system may need additional instruction on this point. It is recommended that this point be included in revised SDEF documentation.
PROJECT IDENTIFIER	14 - 17	4	✓	Alpha.	Left Justified	Existing project numbers in the PPMS-3000 project list may not be overwritten by new SDEF import files. This item is noted in the user documentation on page 15-4. Because an office using PPMS to schedule several different projects may have import files with the same project number, it is recommended that this point be included in revised SDEF documentation.
PROJECT NAME	19 - 66	48	✓	Alpha.	Left Justified	PPMS limits project name to 32 characters; incoming 48-character PROJECT NAME fields will be truncated. It is recommended that this point be included in revised SDEF documentation.
CONTRACTOR NAME	68- 103	36	✓	Alpha.	Left Justified	The CONTRACTOR NAME field was fixed as "CERL-SDEF Test" for export and could not be changed. Importing an SDEF file with a different contractor name did not change the "CERL-SDEF Test" default contractor name. The CONTRACTOR NAME appears to always be set to the licensed user name shown on the PPMS welcome screen. It is recommended that this point be included in revised SDEF documentation.
ARROW OR PRECEDENCE	105 - 105	1	A, P	Fixed	Filled	PPMS supports only Arrow Diagramming. Files that contain precedence schedules will be imported, however, and a warning provided to the user. The SDEF ACTIVITY ID data will be parsed into the I-NODE and J-NODE numbers.
CONTRACT NUMBER	107 - 112	6	✓	Alpha.	Left Justified	The contract number is provided during export as a separate data field and is not saved with PPMS project data.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
PROJECT START	114 - 120	7	✓	ddmmmyy	Filled	The project start field will be included in the SDEF file only if the first activity in the PPMS network has an "activity type" code of "B". This code field identifies the activity as a project start activity with a contractual project start date. Use the last seven characters of the activity description field to include this "plugged date". It is recommended that this point be included in revised SDEF documentation. Also see the "Other Comment" notes in the following table (Calendar Record data format).
PROJECT END	122 - 128	7	✓	ddmmmyy	Filled	The PROJECT END field will be included in the SDEF file only if the PPMS calendar is correct and if the proper sequence of schedule processing has occurred. To set up a proper calendar in PPMS, the starting month for the calendar should be set to 6 months prior to the start of the project and the end of the calendar should be set to 6 months past the completion of the project. Two passes must be made to correctly calculate the project schedule. It is recommended that these points be included in revised SDEF documentation. Also see the "Other Comment" notes in the following table (Calendar Record data format).

Table G4. PPMS Holiday Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	HOLI	Fixed	Filled	None.
CALENDAR CODE	6 - 6	1	✓	Alpha.	Filled	See comments for CALENDAR CODE in the previous table (Calendar Record data format).
HOLIDAY DATE	8 - 14	7	✓	ddmmmyy	Filled	Holiday dates are listed for all weekend and non-work days occurring during the project calendar work days. While these weekend dates are not typically considered as Holidays in the SDEF file, it is likely that these additional dates will simply be ignored by other scheduling systems because those days are non-work days based on the calendar data. The impact of having the weekend days in the SDEF file was not rigorously tested with every other system during the importing process.
HOLIDAY DATE	16 - 22	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	24 - 30	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	32 - 38	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	40 - 46	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	48 - 54	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	56 - 62	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	64 - 70	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	72 - 78	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	80 - 86	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	88 - 94	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	96 - 102	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	104 - 110	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	112 - 118	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	120 - 126	7	-	ddmmmyy	May be Filled	

Table G5. PPMS Activity Record data format.

Description	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	ACTV	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	Note that some systems allow the use of alphanumeric ACTIVITY IDs, which the SDEF does not support. If you plan to import SDEF data, you should provide instructions to project stakeholders, in writing, indicating that only Integer ACTIVITY IDs will be acceptable for that project. It is recommended that this point be included in revised SDEF documentation.
ACTIVITY DESCR.	17 - 46	30	✓	Alpha.	Left Justified	PPMS activity descriptions are 32 characters long. The last two characters of these will be truncated when the SDEF file is exported. Also note that the last several characters of the PPMS activity descriptions are also used depending upon the activity type value for the activity (see page 9-4 of the User's Manual). It is recommended that this point be included in revised SDEF documentation.
ACTIVITY DURATION	48 - 50	3	✓	Integer	Right Justified	None.
CONSTRAINT DATE	52 - 58	7	-	ddmmmyy	May be Filled	CONSTRAINT DATES are entered as the last seven characters of the PPMS activity descriptions. These dates are not masked during the SDEF export and will appear as part of the activity descriptions, possibly confusing other scheduling system users. This item should be noted, in writing, to those accepting SDEF files generated from PPMS. It is recommended that this point be included in revised SDEF documentation.
CONSTRAINT TYPE	60 - 61	2	-	ES or LF	May be Filled	A variety of PPMS activity flags produce ES or LS constraints. Flags "A" and "B" are listed in SDEF output files as "ES" constraints. Flags "E" and "X" are listed in SDEF output files as "EF" constraints. Activities flagged as "M" were not included in the SDEF file. It is recommended that a table showing which flags produce which type of SDEF constraint be included in revised SDEF documentation.
CALENDAR CODE	63 - 63	1	✓	Alpha.	Filled	See CALENDAR CODE comments in the previous table, Calendar Record data format.
HAMMOCK CODE	65 - 65	1	Y, blank	Fixed	May be Filled	When a hammock flag was added to one of the sample projects, the activity appeared correctly in the SDEF output file.

Description	Column Position		Max. Len.	Req. Value	Type	Notes		Comments
WORKERS PER DAY	67 - 69	3	-	-	Integer	Right Justified		Supported. It is recommended that a note about this item being supported by PPMS be included in revised SDEF documentation.
RESPONSIBILITY CODE	71 - 74	4	-	-	Alpha.	Left Justified		Supported. It is recommended that a note about this item being supported by PPMS be included in revised SDEF documentation.
WORK AREA CODE	76 - 79	4	-	-	Alpha.	Left Justified		Supported. It is recommended that a note about this item being supported by PPMS be included in revised SDEF documentation.
MOD OR CLAIM NO.	81 - 86	6	-	-	Alpha.	Left Justified		Not supported. It is recommended that a note about this item not being supported by PPMS be included in revised SDEF documentation.
BID ITEM	88 - 93	6	-	-	Alpha.	Left Justified		Always set to "1". It is recommended that a note about this item always defaulting to "1" be included in revised SDEF documentation.
PHASE OF WORK	95 - 96	2	-	-	Alpha.	Left Justified		Not supported. It is recommended that a note about this item not being supported by PPMS be included in revised SDEF documentation.
CATEGORY OF WORK	98 - 98	1	-	-	Alpha.	May be Filled		Always set to "1". It is recommended that a note about this item always defaulting to "1" be included in revised SDEF documentation.
FEATURE OF WORK	100 - 129	30	-	-	Alpha.	Left Justified		Not supported. It is recommended that a note about this item not being supported by PPMS be included in revised SDEF documentation.

Table G6. PPMS Precedence Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes
RECORD IDENTIFIER	1 - 4	4	PRED	Fixed	n/a
ACTIVITY ID	6 - 15	10	✓	Integer	n/a
PRECEDING ACTIVITY	17 - 26	10	✓	Integer	n/a
PREDECESSOR TYPE	28 - 28	1	✓	S, F, C	n/a
LAG DURATION	30 - 33	4	✓	Integer	n/a
Comment: Precedence projects are not supported by PPMS.					

Table G7. PPMS Unit Cost Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes
RECORD IDENTIFIER	1 - 4	4	UNIT	Fixed	n/a
ACTIVITY ID	6 - 15	10	✓	Integer	n/a
TOTAL QTY	17 - 29	13	✓	Format 8.4	n/a
COST PER UNIT	31 - 43	13	✓	Format 8.4	n/a
QTY TO DATE	45 - 57	13	✓	Format 8.4	n/a
UNIT OF MEASURE	59 - 61	3	✓	Alpha.	n/a
Comment: Unit Cost data is not supported by PPMS.					

Table G8. PPMS Progress Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	PROG	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	None.
ACTUAL START DATE	17 - 23	7	✓	ddmmmyy	Filled if Started	None.
ACTUAL FINISH DATE	25 - 31	7	✓	ddmmmyy	Filled if Finished	None.
REMAINING DURATION	33 - 35	3	✓	Integer	Right Justified	A percent complete value of 50% was added to an activity without an activity start date or remaining duration. The SDEF file containing this activity included the activity with a COST TO DATE amount equal to 50% of the cost of the task, however the remaining duration was the same as the original duration and no activity start date was provided. This is a violation of the SDEF requirements. All activities with an earned value must have an actual start date. Users of PPMS should be warned that updating progress with percent completes may result in incorrect SDEF files. It is recommended that a discussion of this topic be included in revised SDEF documentation.
ACTIVITY COST	37 - 48	12	✓	Format 9.2	Right Justified	None.
COST TO DATE	50 - 61	12	✓	Format 9.2	Right Justified	See comments for REMAINING DURATION field
STORED MATERIAL	63 - 74	12	✓	Format 9.2	Right Justified	Always set to zero. It is recommended that a note about this item not being supported by PPMS be included in revised SDEF documentation.
EARLY START DATE	76 - 82	7	✓	ddmmmyy	Filled if Not Started	None.
EARLY FINISH DATE	84 - 90	7	✓	ddmmmyy	Filled if Not Finished	None.
LATE START DATE	92 - 98	7	✓	ddmmmyy	Filled if Not Started	None.
LATE FINISH DATE	100 - 106	7	✓	ddmmmyy	Filled if Not Finished	None.
FLOAT SIGN	108 - 108	1	+,-	Fixed	Filled if Not Finished	None.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
TOTAL FLOAT	110 - 112	3	✓	Integer	Right Just. if Not Finished	None.

Table G9. PPMS Project End Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Notes	Comments
RECORD IDENTIFIER	1 - 3	3	END	Fixed	None.

Exporting an SDEF File

The SDEF export routine is built into the program structure and is very easy to find and use. The routine prompts users for needed information and quickly creates the SDEF data file. More than one SDEF export file may be created on a floppy disk.

In the **Req. Value** column, a check mark means that the data is required. For a dash (-) in the **Req. Value** column or "See spec" in the **Notes** column, check the explanation for that item in the draft SDEF specification (Appendix A). PPMS has menu selections for SDEF 1990 and SDEF 1993. The SDEF 1990 format is no longer a valid format. **It is recommended that the SDEF 1990 selection be deleted from the distribution version of PPMS.**

Users will need to review material in this Appendix to ensure that a correctly formatted SDEF file is created. **It is recommended that revised SDEF documentation include instructions needed to develop a schedule in PPMS that will output in a correctly formatted SDEF file.**

Importing an SDEF File

Importing routines trap unsupported data to provide users with information about what has been ignored during file import. A list of items that are required for correctly importing to PPMS, as noted in the test report above, should be provided to other project stakeholders. Organizations developing schedules for import into PPMS should be notified, through revision to local specifications, or in writing to ensure that items not supported by PPMS are not included in the SDEF file.

PPMS has menu selections for SDEF 1990 and SDEF 1993. The SDEF 1990 format is no longer a valid format. **It is recommended that the SDEF 1990 selection be deleted from the distribution version of PPMS.**

The import routine may not set the activity type of the first activity to the proper activity type, as noted under the Outstanding Export Routine Issues, item number two

listed above. Users will have to make this change following the import process. **It is recommended that revised SDEF documentation cover this point.**

Existing project numbers cannot be overwritten during the SDEF import routine. This is a useful safety feature of the import routine and is documented on page 15-4 of the PPMS user documentation.

Following the import of an SDEF file, the schedule must be recalculated. This is documented on page 15-9.

It is recommended that the name of the export file have an extension of ".txt". The text file extension is fairly common to the point of becoming almost standard for ASCII files. In addition, the "edit" and "notepad" systems assume ".txt" extensions. **It is recommended that the production version of the SDEF routines provide the default extension of ".txt" for all export files.**

Conclusions

PPMS version 4.02 is recommended for use by Corps and Contractor offices for use in developing SDEF files. If the system is to be used for importing data developed from other systems, the following items should be addressed, either by specification or by separate letter: (1) arrow diagrams only, (2) no unit cost data in the schedule, (3) no stored material costs will be paid only through a separate activity, (4) only one calendar is to be used in the schedule, (5) the MOD/CLAIM NUMBER, PHASE OF WORK and FEATURE OF WORK codes need not be used and (6) BID ITEM and CATEGORY OF WORK codes default to "1" for all activities

Acknowledgments

Appreciation is expressed to Justin Smith, President of Advanced Project Approach, Inc., for numerous discussions with Corps representatives over the course of the testing to resolve various issues.

Appreciation is also expressed to Andrew Havel for his efforts to integrate PPMS programming and algorithms with SDEF requirements.

Test Project Description

The project used to test the system was the small office project used in the Corps of Engineers, the PROSPECT Training course entitled Network Analysis Systems. Figure 27-A contains the arrow diagram for the test project. Costs were added to the network to simulate sample project data. Following creation of the initial schedule, updates were made to the project and an update created.

Appendix H: Primavera, Version 5.1 (DOS)

With additional files and instructions, the production version of the system tested met the SDEF specifications and is recommended for use by Contractors and Corps of Engineers offices. At the time of this report, several additional programming changes, noted below, are being completed. Revised user documentation is also being produced. A complete set of supplemental materials will be available in April 1995. To obtain a copy of the SDEF routines users should contact one of the SDEF Points of Contact noted below. Until the revised documentation is completed, users are encouraged to review this report for supplemental data not found in vendor documentation.

Persons considering the purchase of related products from Primavera Systems should note that only the DOS version of Primavera have SDEF routines.

The SDEF point of contact is Marko Vranich, Technical Support Representative, or Hank Norris, Software Tester, Primavera Systems Inc., Two Bala Plaza, Bala Cynwyd, PA 19004; telephone (610) 667-8600, FAX (610) 667-7894.

Installing the Software

- Did the program tested appear to be a distribution version of the software? **Yes**

Version 5.1 is a distribution version of the program.

- Did the program require additional files not contained on the system disks? **Yes**

An additional program disk was required.

Creating an SDEF-Compatible Project

Once the software was installed, the sample project provided with the supplemental data disk was copied, using P3 routines, to a new project BLD0. The test project was entered into the BLD0 project and the schedule calculated. An update, BLD1, was also created. Both of these projects were saved onto floppy disks using the Primavera

backup utility. A copy of the backup files will be provided to software vendors upon request. SDEF export files will be provided as part of the SDEF Checker program.

- Was SDEF documentation provided with the system? **Yes**

Documentation was provided as separate pre-printed pages.

- Was SDEF documentation sufficient for easy creation of SDEF projects? **Yes**

It is recommended that users copy the SDEF sample project to the new project name because all activity codes and custom data items required are in the SDEF standard project.

Users must install the supplemental SDEF routines in the correct directories. The installation software does not make this obvious. Carefully reading and following the installation instructions contained in the supplemental user documentation is mandatory for successful use of the SDEF routines.

The following tables show how data should be formatted for each record. Comments guide the user in matching the product's data to the SDEF, and indicate any difficulties encountered or recommendations.

In the **Req. Value** column, a check mark means that the data is required. For a dash (-) in the **Req. Value** column or "See spec" in the **Notes** column, check the explanation for that item in the draft SDEF specification (Appendix A).

Table H1. Primavera Volume Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	VOLM	Fixed	Filled	• Is VOLM record on line one (1) of the SDEF file produced for this system? Yes
DISK NUMBER	6 - 7	2	✓	Number	Right Justified	None.

Table H2. Primavera Project Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	PROJ	Fixed	Filled	None.
DATA DATE	6 -12	7	✓	ddmmmyy	Filled	Corresponds to the "Schedule data date" field of the Confirm Selection Screen.
PROJECT IDENTIFIER	14 - 17	4	✓	Alpha.	Left Justified	Corresponds to the "Project Name" field of the Confirm Selection Screen.
PROJECT NAME	19 - 66	48	✓	Alpha.	Left Justified	Corresponds to the "Project Title" field of the Confirm Selection Screen.
CONTRACTOR NAME	68 - 103	36	✓	Alpha.	Left Justified	Corresponds to the "Company Name" field of the Confirm Selection Screen.
ARROW OR PRECEDENCE	105-105	1	A, P	Fixed	Filled	Primavera supports both arrow and precedence diagrams.
CONTRACT NUMBER	107-112	6	✓	Alpha.	Left Justified	The contract number for a project appears to be located in the "Project Number/Version" field of the Confirm Selection Screen. This is not, however, what is output to the correct location in the SDEF file. The contract number that is exported appears to come from the first six characters of the "Report Center Heading" field. CONTRACT NUMBER is imported to the "Report Center Heading" field on the Confirm Selection Screen. Note: Primavera system tester, Mr. Norris, indicates that future versions of the SDEF import export routines will take values from the "Project Number/Version" field for the CONTRACT NUMBER.
PROJECT START	114-120	7	✓	ddmmmyy	Filled	Entering a value for the "Project Start Date" field in the Confirm Selection Screen will constrain the start of the project. A value in this field does not generate a start contract activity in the project schedule with an early start constraint. Since the use of the PROJECT START date in the Project (PROJ) Record is not applied the same way in every scheduling system, it is recommended that users do not fill in a date for the project start date through the Confirm Selection Screen. To ensure that scheduling systems calculate using similar methods, the first activity in the schedule should have a start no earlier than milestone with a date of the contract start date. There should not be any information placed in the "Contract Start Date" field. It is recommended that revised SDEF documentation provide this information.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
PROJECT END	122-128	7	✓	ddmmmyy	Filled	Entering a value for the "Project Must Finish No Later Than" field in the Confirm Selection Screen will constrain the end of the project. A value in this field does not generate a complete contract activity in the project schedule with a late finish constraint. Since the use of the PROJECT END date in the PROJ record is not applied the same way in every scheduling system, it is recommended that users do not fill in a date for the project end date through the Confirm Selection Screen. To ensure that all scheduling systems recalculate the schedule in a similar fashion, the last activity in the schedule should have a late finish milestone with the project completion date. There should not be any information placed in the "Project must Finish no later than" field. It is recommended that revised SDEF documentation provide this information.

Table H3. Primavera Calendar Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	CLDR	Fixed	Filled	None.
CALENDAR CODE	6 - 6	1	✓	Alpha.	See Spec	Primavera can accept alpha-numeric designations for calendar codes, but some systems do not accept these. It is recommended that revised SDEF documentation instruct users to create calendars with only numeric calendar codes.
WORKDAYS	8 - 14	7	SMTWTFS	Fixed	Filled	None.
CALENDAR DESCRIPTION	16 - 45	30	✓	Alpha.	Left Justified	None.

Table H4. Primavera Holiday Record data format.

Description	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	HOLI	Fixed	Filled	None.
CALENDAR CODE	6 - 6	1	✓	Alpha.	Filled	See CALENDAR CODE comments in the previous table (Calendar Record data format).
HOLIDAY DATE	8 - 14	7	✓	ddmmmyy	Filled	Primavera can list repeated holiday dates such as "01JAN" and "25DEC" without specifying the year. The Primavera calendar generation program fills in the years for each of these holidays by substituting the day, or, if on a weekend, following Monday. This feature is not supported by the SDEF format. All holiday dates in the SDEF must have a well-formed date. It is recommended this item be discussed in the revised SDEF documentation.
HOLIDAY DATE	16 - 22	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	24 - 30	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	32 - 38	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	40 - 46	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	48 - 54	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	56 - 62	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	64 - 70	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	72 - 78	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	80 - 86	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	88 - 94	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	96 - 102	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	104 - 110	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	112 - 118	7	-	ddmmmyy	May be Filled	
HOLIDAY DATE	120 - 126	7	-	ddmmmyy	May be Filled	

Table H5. Primavera Activity Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	ACTV	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	Primavera alphanumeric activity identifiers do not comply with the SDEF format; however, alphanumeric identifiers may be approved on a case-by-case basis. This approval is contingent upon the use of software supporting these alphanumeric activity identifiers by all members of the project. If any member's software does not support the use of alphanumeric, then the ACTIVITY IDs shall all be integers. It is recommended that revised SDEF documentation indicate that users should obtain written approval prior to using alphanumeric ACTIVITY IDs.
ACTIVITY DESCR.	17 - 46	30	✓	Alpha.	Left Justified	As noted in supplemental SDEF documentation, Primavera allows activity descriptions of 48 characters. Only the first 30 characters of these descriptions will be exported to the SDEF file.
ACTIVITY DURATION	48 - 50	3	✓	Integer	Right Justified	None.
CONSTRAINT DATE	52 - 58	7	-	ddmmmyy	May be Filled	None.
CONSTRAINT TYPE	60 - 61	2	-	ES or LF	May be Filled	Primavera supports many different types of constraints that are not supported by the SDEF. Only the early start and late start dates of activities may be constrained in the SDEF. As is briefly discussed in the supplemental SDEF documentation, additional treatment of this subject is needed to be sure users do not add constraints to projects that are not supported by the SDEF. It is recommended that the two constraints supported by the SDEF are specifically identified in revised SDEF documentation. Also note that the use of Primavera's "milestone" and "flag" activities may result in incorrect SDEF files. Users should check with Mr. Norris prior to using either of these types of activities on SDEF projects. It is recommended that future SDEF documentation address the use of these types of activities.
CALENDAR CODE	63 - 63	1	✓	Alpha.	Filled	See the CALENDER CODE comments in Table H3 (Calendar Record data format) for information on this topic.
HAMMOCK CODE	65 - 65	1	Y, blank	Fixed	May be Filled	None.

Table H6. Primavera Precedence Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	PRED	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	See comment for ACTIVITY ID in the previous table (Activity Record data format) regarding the use of alphanumeric values.
PRECEDING ACTIVITY	17 - 26	10	✓	Integer	See Spec	See comment for ACTIVITY ID in the previous table (Activity Record data format) regarding the use of alphanumeric values.
PREDECESSOR TYPE	28 - 28	1	✓	S, F, C	Filled	Primavera allows predecessor types that are not allowed in the SDEF. The three types that SDEF does support are "S" for Start-to-start, "F" Finish-to-finish and "C" Finish-to-Start". It is recommended that the specific predecessor types that are supported by the SDEF be identified in revised SDEF documentation.
LAG DURATION	30 - 33	4	✓	Integer	Right Justified	Primavera allows negative lag values. Negative lags are not allowed by the SDEF. It is recommended that the revised SDEF documentation instruct users not to use negative values for lag.

Table H7. Primavera Unit Cost Record data format.

[illegible]

Table H8. Primavera Progress Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 4	4	PROG	Fixed	Filled	None.
ACTIVITY ID	6 - 15	10	✓	Integer	See Spec	See comment for ACTIVITY ID in Table H5 regarding the use of alphanumeric values.
ACTUAL START DATE	17 - 23	7	✓	ddmmmyy	Filled if Started	It is possible to have a remaining duration of less than the original date without having an ACTUAL START DATE. During export of the data file, the calculated EARLY START DATE plus the REMAINING DURATION is placed in the EARLY FINISH DATE field. Allowing a REMAINING DURATION of less than the original duration without an ACTUAL START DATE is prohibited by the SDEF. It is recommended that a check be made during export to ensure that an ACTUAL START DATE field is provided for all activities where the REMAINING DURATION is less than the ORIGINAL DURATION. Pending inclusion of this check, revised SDEF documentation should explain the SDEF requirement for an ACTUAL START DATE. This item will not keep the system from being recommended for SDEF export/import. Primavera software tester, Mr. Norris, indicates that changes will be made to the export routines to ensure that data consistent with the SDEF is provided.
ACTUAL FINISH DATE	25 - 31	7	✓	ddmmmyy	Filled if Finished	It is possible to have a REMAINING DURATION equal to zero (0) without having an ACTUAL FINISH DATE. During export of the data file, nothing is placed in the ACTUAL FINISH DATE field. The EARLY FINISH DATE is set equal to the day before the data date. The LATE FINISH DATE is calculated based on the value provided from the backward pass. A TOTAL FLOAT of zero days is listed as the float for the activity. Provision of a default calculation for ACTUAL FINISH DATE is prohibited by the SDEF. It is recommended that a check be made during export to ensure that ACTUAL FINISH DATES be provided for all activities where the REMAINING DURATION is equal to zero. Pending inclusion of this check, revised SDEF documentation should explain the SDEF requirement for an ACTUAL FINISH DATE. This item will not keep the system from being recommended for SDEF export/import. Primavera software tester, Mr. Norris, indicates that changes will be made to the export routines to ensure that data consistent with the SDEF is provided.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
REMAINING DURATION	33 - 35	3	✓	Integer	Right Justified	Primavera supports both remaining duration and percent complete. According to user documentation percent complete may be used to generate both remaining duration and percent complete. Note that the percent complete field, based on the remaining duration does not update the "Actual to Date (ACWP)" field needed to export the correct value to the SDEF for cost progress. Revised SDEF documentation should indicate that REMAINING DURATION is the preferred method of determining time-based progress as required by the SDEF.
ACTIVITY COST	37 - 48	12	✓	Format 9.2	Right Justified	First make sure that the resource shown in the Activity Form, Budget Summary Window, is either "COST0001" or the value of the resource such as "LUMP SUM" that you have created. The resource name "COST0001" may be modified under the Resource Dictionary Window. Next place the value for the budgeted activity cost in the "Budgeted Amount" field. No value is required if the activity has a resource that uses unit costs (see the Unit Cost Record for additional information). It is recommended that revised SDEF documentation contain a discussion of this item.
COST TO DATE	50 - 61	12	✓	Format 9.2	Right Justified	First make sure that the resource shown in the Activity Form, Budget Summary Window, is either "COST0001" or the value of the resource such as "LUMP SUM" that you have created. Next place the value for the activity's earned value, in the "Actual to Date (ACWP)" field. Even though the definition of the SDEF field is an activity's earned value, the "Earned Value" field in Primavera was not used. The differences in nomenclature are due to the variety of influences which impact cost control for projects. The COST TO DATE field may be filled by either copying the number in the "Earned Value" field, generated through the use of the time-based percent complete, or by entering the actual value earned. No value is required if the activity has a resource that uses unit costs (see the Unit Cost Record for additional information). It is recommended that revised SDEF documentation contain a discussion of this item.
STORED MATERIAL	63 - 74	12	✓	Format 9.2	Right Justified	This is contained in the Custom Data Item Window of the Activity Form. When exported, the program did not add the value in STORED MATERIAL to a zero cost to date and report a cost to date equal to the STORED MATERIAL. The SDEF requires that STORED MATERIAL be a subset of the COST TO DATE of an activity. It is up to the users to ensure that this constraint is met. It is recommended that this item be included in revised SDEF documentation.
EARLY START DATE	76 - 82	7	✓	ddmmmyy	Filled if Not Started	None.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
EARLY FINISH DATE	84 - 90	7	✓	ddmmmyy	Filled if Not Finished	None.
LATE START DATE	92 - 98	7	✓	ddmmmyy	Filled if Not Started	None.
LATE FINISH DATE	100-106	7	✓	ddmmmyy	Filled if Not Finished	None.
FLOAT SIGN	108-108	1	+,-	Fixed	Filled if Not Finished	None.
TOTAL FLOAT	110-112	3	✓	Integer	Right Just. if NotFinished	Primavera requires the use of a custom data item to support this field. The custom data item, TFLO, as noted in supplemental SDEF documentation, is provided with the sample SDEF project.

Table H9. Primavera Project End Record data format.

SDEF Field	Column Position	Max. Len.	Req. Value	Type	Notes	Comments
RECORD IDENTIFIER	1 - 3	3	END	Fixed	Filled	None.

Exporting an SDEF File

SDEF export/import routines are provided under a separate set of executable and batch files. Single-user versions of Primavera require that the user exit Primavera prior to invoking the export routines.

As noted in the user documentation, the SDEF export/import program must be located in the correct directory for the program to operate correctly. If the "p3sdef" program terminates unexpectedly, please review the installation instructions for the proper location of the programs.

The system uses "resources" to allocate cost and unit costs to each activity. First-time users of the SDEF export routine who have not followed the instructions above regarding cost items and unit costs, will very likely produce incorrect SDEF export files. Care must be taken to enter data as discussed in the previous discussion so that the export routine creates a correct SDEF file.

The export routine assumes that the file is to be saved on the same drive and path as the P3 program files. This is an awkward arrangement for those who use the system but are not computer literate. Users are forced to do selective directory listings to find the files that were produced. **It is recommended that the production version of the SDEF export routine be modified to allow users to specify the location of the export file.** The Primavera software tester, Mr. Norris, indicates that exporting to floppies will not be included in the SDEF export routines at this time.

The file name produced does not have a ".txt" extension. As a result, users may have to rename the files produced prior to creating the data disk. **It is recommended that the production version of the SDEF export routine be modified to include the ".txt" extension as part of every file name.** Primavera software tester, Mr. Norris, indicates that export routines will add the "txt" extension if none has been provided.

Importing an SDEF File

SDEF export/import routines are provided under a separate set of executable and batch files. Single-user versions of Primavera require that the user exit Primavera prior to invoking the export routines.

The import file fails when importing an project with a name that is already in the P3 project listing.

Unit cost data was imported with the following results:

1. The TOTAL QUANTITY field was truncated from the SDEF requirement of 8.4 to the P3-allowable value of 5.2. For example, the number in an SDEF file of "12345678.1234" was imported as "45678.12".
2. The COST PER UNIT field was truncated from the SDEF requirement of 8.4 to the P3-allowable value of 5.2. For example, the number in the SDEF file of "98765432.1234" was imported as "32.00".
3. The first COST PER UNIT value encountered in the SDEF file was imported, as noted above. This value appeared in the resource dictionary under the appropriate location. **IMPORTING MORE THAN ONE UNIT COST ITEM IN A FILE WILL RESULT IN INCORRECT IMPORT OF THE UNIT COST DATA. Primavera may have a fix for this item by the time of publication of this report. It is recommended that any users interested in unit costs contact P3 technical support to determine the current status of the unit cost routines.**

Conclusions

Due to the complexity of resource information available in the system, it is likely that casual users will have difficulty creating correctly formatted SDEF cost information. User documentation should be improved to provide more specific instructions. Users who need Unit Cost data should contact P3 support.

The requirement that users copy files may be too much for casual computer users. SDEF programs should be modified to support different disk drives and file names.

Acknowledgments

Appreciation is expressed to Mr. Norris and Mr. Vranich for numerous discussions with Corps representatives over the course of the testing to resolve various issues.

Test Project Description

The project used to test the SDEF export was a four-story building based on the activity list shown in the table below. An alphanumeric identification scheme was used in this schedule. For example, the first floor Structural Steel and Pan Forms activity has an activity identification of "101A", the second floor "101B" and so on, through the fourth floor. Activities were added for the Submittal, Approval and Delivery phases.

Table H10. Primavera test project.

Number	Description	Duration	Priors
1	Structural Steel and Pan Forms	5	
2	Place Floor Slab	16	1
3	Steel Studs for Partition Walls	8	2
4	Wall Insulation	5	10
5	Mechanical Rough-In	7	10
6	Electrical Rough-In	7	10
7	Install Finish Drywall	7	4, 5, 6
8	Doors and Hardware	8	7
9	Painting	5	8
10	Exterior Siding	8	3
11	Appliances and Furnace	6	9
12	Floor and Trim	3	11
13	Bathroom and Kitchen Cabinets	3	13
14	Finish Plumbing	5	11, 13
15	Finish Electrical	5	11, 13
16	Install Furnishings	2	14, 15

DISTRIBUTION

Chief of Engineers

ATTN: CEHEC-IM-LH (2)

ATTN: CEHEC-IM-LP (2)

ATTN: CECC-R

ATTN: CERD-L

ATTN: CEMP-C

ATTN: CEMP-CE (2)

ATTN: CEMP-E

ATTN: CEMP-ES (2)

US Army Engr District

ATTN: Library (40)

ATTN: Chief/Project Management (40)

ATTN: Civil Construction/Civil Con-Ops (40)

Sacramento District

ATTN: ARMS TCX (2)

US Army Engr Division

ATTN: Library (12)

ATTN: Chief/Project Management (12)

ATTN: Civil Construction/Civil Con-Ops (12)

Defense Tech Info Center 22304

ATTN: DTIC-FAB (2)

172

05/95